SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLVI.—No. 22. [NEW SERIES.] NEW YORK, JUNE 3, 1882. [$3.20 per Annum. [POSTAGE PREPAID.]

NEW ORE ROASTING FURNACE.

We give an engraving of a revolving cylinder ore roasting and chloridizing furnace of the class that is operated by two fires, and in which complete or partial desulphurization or oxidation of the ore is effected before the beginning of the chlorinating process.

The furnace is composed of three revolving cylinders of different diameters and lengths, longitudinally connected and communicating with each other, having a fire box at each end and suitable dust chambers, and provided with novel internal stirring and ore pulverizing devices, with internal air supply pipes, and with external automatically operating salt box and ore discharge pipe.

The larger engraving is a longitudinal elevation of the furnace. Fig. 2 is a longitudinal sectional elevation. Fig. 3 is a vertical sectional elevation. Fig. 4 is an enlarged transverse section.

In the engravings, A is the cylinder of least diameter and greatest length, designed to be about 12 feet long and about 4 feet in external diameter, the cylinder being constructed in one or more flanged sections bolted together. The shortest cylinder, B, is designed to be about 2 feet long and of about 6 feet external diameter, bolted through its flanged end to the flanged end of cylinder A; and C is the cylinder of greatest diameter, designed to be about 4 feet long and about 80 inches in external diameter, bolted by its flanged end to the opposite flanged end of the cylinder B. This furnace, A B C, is provided with suitable encircling rings or tires, that bear on supporting anti-friction rolls, whose shafts are journaled in supporting frames, the rolls nearest the ends of the furnace having annular flanges to prevent longitudinal movement of the furnace. Encircling the cylinder B is a toothed gear, E, meshing with a small cog wheel on the drive shaft. This furnace is designed to be set at about an inclination of one inch in six feet, inclining downward from the smaller to the larger end.

The cylinder A is longitudinally corrugated, as shown, forming a series of parallel and alternate depressions and projections on the inside. Along these projections are bolted angle irons, extending from one end to the other of the cylinder, and forming, in combination with the depressions, a series of buckets for lifting or stirring the ore as it passes through the furnace, the buckets lifting the ore and letting it fall through the flame or hot air passing through the furnace, and exposing it at the same time to the air admitted through the air pipes, that will presently be described. These depressions are designed to be about four inches deep. The cylinder C is also longitudinally corrugated in the same manner as cylinder A, and has angle irons secured along its inward projections, and extending partly over the depressions, forming buckets for lifting and letting fall the ore to expose it to the furnace reactions. Fire brick or angle irons are used to project the falling ore into the body of the furnace, also covering the space between the buckets and protecting the shell of the furnace from the action of heat, and also to project the falling ore farther into the body of the furnace. In the case of the cylinder C, the corrugations terminate a short distance from the head, thereby leaving the cylinder at that point of the diameter of the outside of the buckets, forming a gathering trough for the ore. To an opening in this trough is attached a peripheral discharge pipe provided with a valve.

The cylinder B is plain, but is lined with a slightly corrugated lining, as shown in Fig. 3, and has annular flanges at each end, and through the flange next to the cylinder C are orifices corresponding in number and location with the buckets in the cylinder C. In this cylinder B are a number of iron balls, whose function is, as the furnace revolves, to pulverize the agglutinated lumps of ore and mix the ore with the reagents fed from the salt box.

In the sides of the cylinders A C are inspection ports covered with mica, held in place by frames bolted to the cylinder, and a manhole is formed in the head of the cylinder C for the convenience of entering and cleaning or repairing the furnace, A B C.

At the higher end of the furnace, A B C, is a fire box, F, from which a fixed cylindrical flue extends a short distance into the cylinder A, to convey therein the products of combustion from the fire in fire box, F, and at the opposite end of the said furnace, A B C, are the fire box and dust collecting chambers communicating with the smoke stack.

A conically-shaped flue, H, extends from the dust chamber through the furnace head, to which it is fitted and firmly fastened, to a point corresponding with the line of junction between the cylinders B C, and its inner end is supported by a spider that encircles and radiates from the air pipe, M. This flue, H, revolves with the furnace, A B C.

[*Continued on page 348.*]

Fig. 2

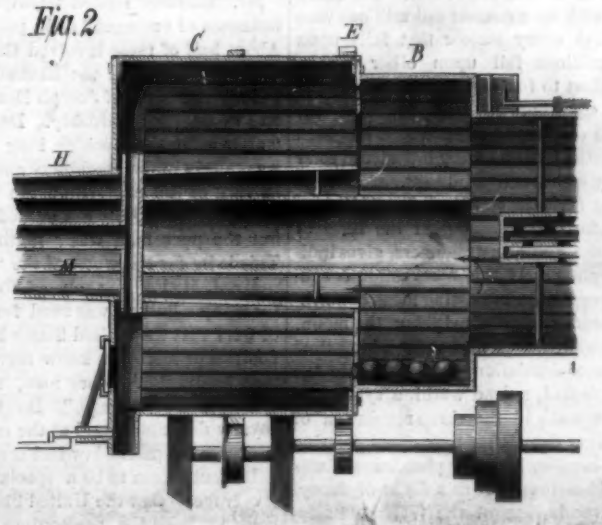
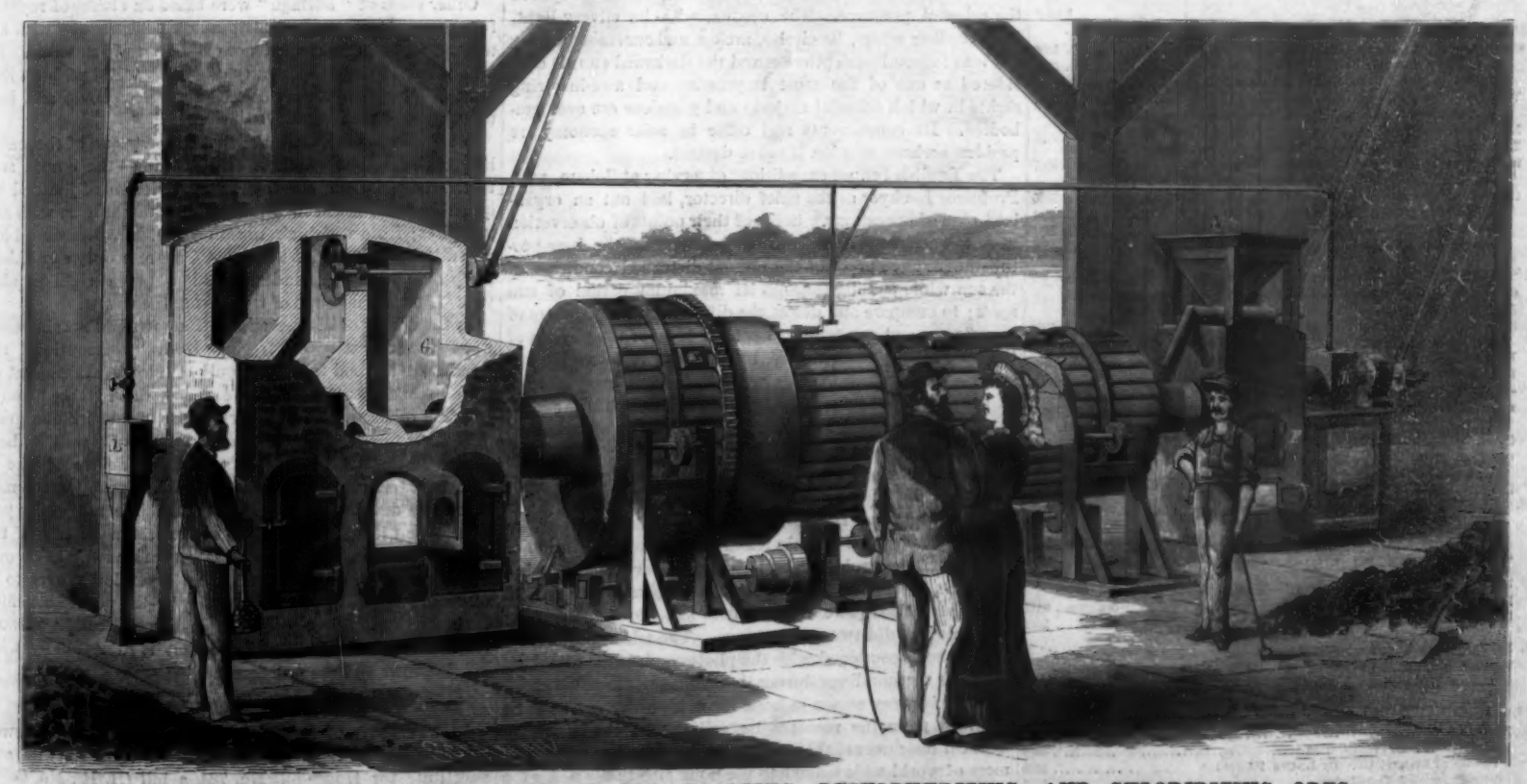


Fig. 3

Fig. 4

NEW ORE ROASTING FURNACE.



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Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, JUNE 3, 1882.

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THE TOTAL SOLAR ECLIPSE.

The solar eclipse of the 17th of May was successfully observed by English, French, and Italian parties at Soham, a village in Lower Egypt, on the Nile. The duration of totality at that point was only seventy-two seconds, but the observers did prompt and efficient work in this short space of time. The telegraph swiftly bore the record of their labors to our Western World, and the first-fruits include the view of a comet near the sun, indications of a lunar atmosphere, and a photograph of the spectrum of the corona.

The precious seconds when the sun's face was hidden by the moon's dark shadow revealed in the first place a comet near the sun. It could not be Comet *a* or Comet Wells, for this much talked of visitor to northern skies does not reach perihelion until the 10th of June, and has, therefore, three weeks' time in which to speed its course to the near neighborhood of the great luminary. It will be comforting to those who have borrowed trouble from its close approach to the solar fires to know that another comet, eluding the grasp of terrestrial observers, is safely circling around the magnet of the system without let or hinderance. It has not thus far fallen into the sun to add fuel to his flames and bring destruction to the earth. It will doubtless keep on its harmless course and pass with quickened step beyond solar bounds to star-depths unfathomable, as myriad other comets have done before and will do again, for observation confirms the theory that space is full of comets, meteors, and intangible forms of matter. A small portion of the mighty army becomes visible in the form of comets and meteors, but the invisible denizens of space far exceed those that are visible. For every comet that spans the sky with its gossamer tail millions pass over our heads unseen. For every meteor that falls upon our world millions of millions fall upon other worlds, while vain would be the effort to form any idea of the infinite numbers of those that fall upon our sun, or the countless suns of space. The comet seen near the darkened sun has been photographed, and the picture of the daring intruder in solar domains will form a study of attractive interest.

The second item coming from the eclipse observers is more astounding than the first, for the darkening of the lines of the spectrum, as seen by the French astronomers, gives indication of a lunar atmosphere. If this observation is substantiated there will be a revolution in existing ideas concerning lunar physics. Our nearest celestial neighbor, the moon, at least the side turned toward the earth, has for a long time been considered the abode of desolation, her purpose in the material economy accomplished, a dead world, a symbol of the fate in reserve for the earth in the slow revolution of ages. Years ago an observer detected a rosy cloud floating over the lunar crater Linnæus, but the phenomenon was looked upon by more staid astronomers as a flight of fancy. A few years ago an observer in one of the Western States detected a change of form and an appearance of volcanic action around one of the moon craters, but the scientific world in general considered it an optical illusion. It may be that these observers were not so far out of the way, though the startling discovery will not be accepted without strong proof to verify it. Those who are best acquainted with the moon as seen in the telescope will be slow to believe in the slightest manifestation of life on her chaotic surface.

One more meager item closes the first bulletin from the eclipse expeditions. It is that the spectrum of the corona was photographed for the first time. We may, therefore, hope for increased knowledge of the constitution of the sun's magnificent appendage, seen only in a total eclipse, so grandly beautiful as to make the beholder feel like veiling his eyes in the celestial presence. The corona, with its silvery light, its spreading wings, its circles, arches, and curves stretching out into fathomless depths around the darkened sun, is considered as one of the most impressive and awe-inspiring sights in which celestial majesty and grandeur are ever embodied. Its constituents and office in solar economy are problems whose solution is much desired.

The English eclipse expedition, observing at Soham, with Professor Lockyer as the chief director, laid out an organized plan of operations. Some of their points of observation were to note if the abundance and activity of the rosy protuberances gave proof of the present disturbed condition of the sun while passing through its maximum period of sun spots; to compare and detect the difference in the spectra of rosy flames and sun spots; to get an idea of the physics of the solar atmosphere—that is, to find what it looks like, to study—if the expression may be used—its circulatory system; and to determine its chemical nature, especially if the chemical elements existing in the sun are dissociated or separated by the intense temperature existing there. Special attention is now directed to solar physics and chemistry, in consequence of the bold and ingenious theory of Dr. Siemens on the conservation of solar energy.

Photography was greatly relied upon in the solution of these intricate problems, and so much have methods improved in the rapidity with which the image can be impressed on the sensitized plate that seconds will now record more than minutes did twenty years ago. The telescope and the spectroscope combined with the photograph in the attack on the sun's surroundings during the eclipse.

There is every reason to hope for noteworthy results to be obtained from the recent solar eclipse with the best astronomical instruments the world can furnish, and with astronomers of world-wide renown to use them effectually under the cloudless sky and in the serene atmosphere of the station on the Nile. We have still to hear from other stations on the thin line of totality, and to wait for fuller details and photographs that will tell more of the good news.

Professor Lockyer and his assistants spent three months in hard work to prepare for seventy-two seconds of observation. They traveled thousands of miles and transported thirty cases of instruments to aid them in the work. If their time, talent, and labor have succeeded in drawing a single secret from the sun, or helped to confirm a single theory, the reward is all they ask; they have not labored in vain. For this heaping up of observation upon observation is the work of the present generation of astronomers, the only means of wresting knowledge from our sun, our brother planets, and the suns that people space.

INSATIATE VAMPIRES IN MICHIGAN.

It is a fortunate circumstance that Mr. Burrows did not content himself with denouncing in general terms, in his peculiarly forceful style, "the bands of patent right inquisitors which infest the country and plunder the people." He was so good as to give examples of their outrages, "samples of the persecutions to which farmers are subjected," thereby making it possible for people who use words with some regard for their meaning to form an idea of the nature and behavior of those "insatiate vampires" who are "hunting down" the farmers of the great West. Otherwise it would not be possible to believe that any portion of the American people would "frequently submit," as Mr. Burrows says his constituents do, "to outrageous exactions under the threat of judicial inquisition," or to "unjust persecutions," or to being "plundered without stint or mercy."

Mr. Burrows recited twenty-eight "well authenticated instances of outrages" upon people of his district and State, About half of these involved the collection of a royalty of $100 for the use of the Birdsell clover huller, "valued at $450." The case of Joseph Dean, of Colon, is described as one of peculiar hardship. Dean bought a clover huller; "after using the machine long enough to earn $40, his arm was caught in the machinery and he was crippled for life." In view of this misfortune the insatiate vampire who came to collect the royalty discounted Dean's liability 50 per cent; but the poor man was "plundered" of $50 nevertheless. This is by far the worst of the "outrages" reported.

Mr. J. M. Failling refused to pay the royalty demanded for using a huller; was sued for it; "and learned at a cost of $417 that the United States District Court of the Eastern District of Michigan knew more of the value of the patent than he did." Another man, name not given, suffered a still greater "outrage." He too refused to pay the $100 royalty demanded, and at the end of a suit "found that his education in patent law had cost him $500."

It would seem to be a specially annoying feature of these "outrages" that the United States Courts are in substantial collusion with the persecutors and sustain their iniquitous demands.

Another remarkable feature of these cases is the curious fascination which clover hulling machines seem to have upon the minds of Mr. Burrows' constituents. They will use them even at the risk of having to pay royalty therefor to the "vampires" who own the patents. How can we account for such infatuation? Can it be, as has been suggested, because the hullers are profitable things to have?

There seem to be several varieties of these fascinating clover hullers, for several of different makes serve as the basis of "well authenticated outrages." In some cases royalties as high as $125 have been demanded for their use; and those who have resisted the "unjust exaction" have had to pay it in the end, with heavy court expenses added.

Other cases of "outrage" were based on claims of royalty for the use of a circular saw guide, a sawmill dog with attachments, and other trifles, not exceeding $75 in value. In all but one of these the royalty of $50 was paid without litigation. Mr. Fred. Spicer carried his case to court and had to pay $91.50 with costs.

It is a notable circumstance that in every one of the cases litigated—save one which is still pending—the courts sustained the patentees, and the innocent victims of judicial inquisition fared worse than those who settled at once with the vampires; from which circumstance Mr. Burrows would apparently have it understood that Congress only can shield the people from the plundering raids of patent right inquisitors. There is no hope of relief from the courts.

In the course of his speech Mr. Burrows laid special stress upon the necessity of freeing from "persecution" the purchasers in good faith, not only of clover hullers but of patent fence gates, barbed wire fence, drive-wells, "and a hundred other articles necessary to the farmers of the great West;" but none of these figure in his list of "well authenticated outrages." No doubt many farmers would like to enjoy the free use of these patented inventions; but the men who have devised and developed them are not easily persuaded that it is wrong for them to expect a portion of the profit resulting from their use. It is a curious way to encourage invention to enact that when an invention proves to be of great utility—a public "necessity"—the people benefited by it can demand and obtain its legal confiscation without recompense to the inventor; and that is substantially what Mr. Burrows and the rest demand.

LEGISLATIVE CONFISCATION.

In the House of Representatives, April 28, Mr. Caswell asked consent to report from the Committee of Patents, as a substitute for House bill No. 784, a bill (H. R., No. 6018), providing that no action for damages or proceeding in equity shall be sustained, nor shall the party be held liable under

Sections 4919 or 4921 of the Revised Statutes of the United States, for the use of any patented article or device when it shall appear on the trial that the defendant in such action or proceeding purchased said article for a valuable consideration in the open market.

Objections were raised. Mr. Hutchins said: "It seems to me that a bill of that kind, nullifying the patent laws of the United States, ought not to pass without our understanding it."

Mr. Vance said: "This has received the unanimous consent of the Committee on Patents, and also the approval of the Commissioner of Patents, and it has been petitioned for extensively by the people."

Failing to obtain an immediate consideration of the bill, Mr. Caswell asked that it be placed on the House Calendar, and the bill, with the accompanying report, be printed. His request was granted.

Thinking it very strange that the Commissioner of Patents should, as Mr. Vance alleged, approve of a bill "nullifying the patent laws of the United States," as Mr. Hutchins aptly described it, we caused inquiry to be made at the Patent Office, discovering that it was not true that the commissioner ever approved the bill; that Mr. Vance must have "misunderstood" a letter which the commissioner had written in reference to another bill on the same subject, a bill which was never introduced to the House.

The matter was brought before the House again, May 15, by Mr. Caswell, who asked the immediate passage of the substituted bill under a suspension of the rules. Mr. Caswell declined to state the reasons for the bill until after the opposition had exhausted the brief time allowed them for remarks.

Mr. Robinson, of Massachusetts, protested against hasty action upon a bill which, under the guise of protecting the innocent purchaser, protected others who ought not to have any protection, but against whom the whole power of the Congress ought to be invoked in aid of the inventor who may have put the energies of his life and all the means of himself and family into the invention that he has made. "This bill," he said, "undertakes to protect those parties who, it is said, have bought inventions in open market for a valuable consideration. But what remedy is afforded to the patentee? He is turned back to the person who sold the instrument or machine, and is deprived of redress against the party using it; and the seller is ordinarily, perhaps wholly, worthless—is an irresponsible person from whom no damages can be recovered. Thus you relieve from liability the man who ought to be responsible and who ought to pay the damages."

Mr. Rice, of Massachusetts, called attention to the confusion and injustice that would result from the operations of the proposed law. "There are machines, the product of which in a single year would be a fortune to any man. Under this bill the man buying one of these machines in open market, for a valuable consideration, has the advantage over everybody else who may use similar machines. He cannot be interfered with, his use of the machine cannot be stopped, he cannot be made to pay damages, while everybody else may be held to liability for unauthorized use of the invention. Hence the result of this bill would be injustice and confusion in all the mechanical and industrial branches of business. Certainly the gentleman from Wisconsin (Mr. Caswell) does not wish to tear up, root and branch, the entire patent law of the country, as he surely would do by the adoption of this bill."

Mr. Caswell admitted that the bill might impair to some extent the rights of patentees in their patents; but, on the other hand, it would "give relief to more than one hundred persons who have purchased a patented article in entire good faith and are innocently using it." That these persons had any just ground for claiming such relief at the cost of patentees was not asserted; but it was assumed that they must have it because they noisily demanded it. Said Mr. Caswell: "The time will come, unless something is done to protect a man who purchases an instrument in open market for his use without notice, when there will be an uprising, and they will overthrow the patent laws."

Mr. Springer asked: "What is there in this bill to prevent an irresponsible person from selling the most valuable patent right and giving a good title to it and allowing the purchaser to use it during the lifetime of the patent without any remedy on the part of the patentee against the purchaser?"

"I conceive that abuses may arise," said Mr. Caswell; then he went on to declaim about the hardships of his innocent clients, but showed no disposition to consider the question whether the real abuses introduced by the bill would not exceed the alleged abuses arising from the over-readiness of Wisconsin farmers to buy patented articles from unauthorized and irresponsible venders.

Mr. Peelle, who favored the bill, made the grotesque remark that the bill would "most likely have a tendency to admonish patentees to be more careful in the disposition they make of their patented articles."

A law to prohibit the recovery of stolen cattle, sold "in open market," to "purchasers in good faith," would be equally pertinent, and would similarly admonish farmers to be more careful of their live stock; but it is doubtful whether they would be grateful for the admonition.

The main champion of the bill was Mr. Burrows, of Michigan, who made a blustering demand that his constituents should be protected from "the bands of patent right inquisitors, which infest the country and plunder our people." After reciting some "well authenticated instances of outrages" to which the people of his district had been subjected by "patent right inquisitors," Mr. Burrows said: "In some instances the vender and the owner of the patent seem to be in collusion. For instance, a set of men go through the country with wagon loads of gates, and dispose of them to the farmers, who pay a full consideration and have no knowledge that they are patented, and after they are set up and in daily use another set of men scour the country and notify the purchasers of these gates that the hinge or some other portion of it is patented, and that they are the owners of such patent, and thereupon a demand is made for five, ten, or twenty dollars damages for infringement, and if payment is refused suit is threatened in the United States Court. To avoid this they often submit to an outrageous exaction; and so, under threat of judicial inquisition, our people are being plundered without stint or mercy. I hope this measure will receive the prompt approval of this House, that the people who purchase patented articles in the open market in good faith and for a full consideration, shall not be hunted down by these insatiate vampires."

This seems to have carried the day.

It was temperately suggested that a bill taking from inventors the right of property vested in them by the constitution ought not to be forced through under a suspension of the rules and without proper consideration; that the indefinable "open market" would be a fruitful source of trouble; that it would not be wise to deprive the country of the benefits of the patent laws to cure an evil that could be reached in a better way; that, in the words of Mr. Hewitt, the bill was "confiscation, not legislation," and so on; but without avail.

The picture of insatiate vampires going about the country and plundering people without stint or mercy, to the extent of five, ten, and fifteen dollars damages, for infringements, was overpowering, and the bill was passed. We may note here that just before the vote the Commissioner of Patents was again cited as having expressed himself in favor of the bill.

According to the press reports, the disorder which prevailed in the House, while the bill was before it, was so great that it was difficult to understand any of the speakers. It was not desired that speakers should be heard, the manifest aim being to choke off discussion and to rush the bill through. Elections are coming, and farmers' votes are coveted.

It would be interesting to know how many of the 155 members who voted for the bill would have done so had there been any likelihood of its being favorably considered by the Senate. The opportunity to make temporary political capital without serious risk was too good to be lost.

The only public damage likely to result from this seeming triumph of misrepresentation and the other acts of the demagogue is that certain people may be encouraged in expecting that Congress can and will, some time or somehow, exempt them from the natural consequences of indiscriminate trading with irresponsible venders of property to which the venders cannot give good title. Congress has no power to override the Constitution; and any attempt it might make to invade—as this bill proposes to do—the constitutional rights of patentees, would be promptly thwarted by Executive veto or by Supreme Court decision. The infringement of patent rights cannot be legalized, and in pretending to try to do it vote-seeking politicians merely trifle with and play upon the prejudices of their constituents.

TUBERCLE PARASITE.

Prof. Tyndall's letter in relation to the discoveries of Dr. Koch as to a parasitic vegetation which he has found to cause consumption, has justly excited public attention. Hitherto the medical profession confess to an ignorance of the real intimate nature of consumption. Terminology even shows this, besides showing the poverty of language. Literally, "consumption" means to consume. "Phthisis," a synonym, is derived from a Greek word—*phthio*, "I dry," "I fade." Tubercle is the diminutive of tuber, meaning a little tuber. A potato is a tuber, but little potatoes are not tubercles, or little "knots" or "kernels." Consumption is not always attended with tubercles or little knots in the lungs.

Tubercle is regarded as an accidental result of the disease, and while tubercle occurs in connection with consumption, consumption occurs without tubercle. Lately phthisis has been further divided up into fibrous, caseous, etc., according to the lesions produced. There is so much refinement in distinctions that one who had made a specialty of consumption for nearly a half century wrote, not long ago, that if he followed modern writers he did not know as he could tell a case of consumption when he saw it. But taking the disease as ordinarily found and noted in the bulletins of our boards of health—and this is what Prof. Tyndall refers to in his letter—tuberculous consumption is characterized generally by wasting and by local death and breaking down of the lungs previously invaded with tubercles—the phthisis pulmonalis of authors.

Prof. Tyndall tells us in his letter that Dr. Koch has discovered and cultivated a bacillus or parasitic vegetation which he cultivated to many generations, by means of whose inoculation quite a number of small animals have died of consumption or tubercle thus artificially induced. Now, what is a bacillus? It is not an animalcule or little animal, or infusoria, but a plant like to or the same as those described for some years as bacteria, and which were regarded as a supposed genus of oscillatoriaceæ or confervoid algæ, which has been noted in natural history as one of the earliest organisms appearing in decaying and putrefying animal and vegetable solutions; by some supposed to cause decomposition and to form the migrozymes of zymotic diseases. "Bacillus" means a stick, and "bacterium" about the same. There is, however, a difference of opinion among observers, some regarding the bacteria, bacilli, etc., as simply the embryonic forms of vegetation capable of reproduction in this stage. Others, as Koch, regard them as ultimate forms of vegetation. The former would regard the bacilli as simply the automobile protoplasmic seeds of a vinegar yeast, or *Mycoderma aceti* of some writers, which is the tough gelatinous leathery mass floating on the surface of fluids rich in sugar when undergoing fermentation at ordinary temperatures, and conversion into vinegar called the "the mother of vinegar," and which, growing on animal soil, has as one of its results the so-called "tubercle."

But it has been some time ago reported by some European observers that consumption in animals has been induced by the inoculation of foreign substances into the animal economy, by subcutaneous injection under the skin and into the blood, the tubercles being produced by the mechanical and chemical effects, blocking up the capillary vessels and the interference with the nutrition of the part. Now, this embryonic form of the vinegar yeast was found in 1858 by Dr. J. H. Salisbury, of this city, in the blood, sputa, and excretions of persons suffering with consumption. In the blood the plant forms masses by itself, grows inside the white blood corpuscles, causes the fibrin filaments of the blood to be larger in size and stronger, the red blood corpuscles to be ropy, sticky, adhesive, making small clots or "thrombi," which become "emboli" or plugs, and block up the capillaries and blood vessels. The growth of the vinegar yeast in its embryonal stage, combined with the mechanical interference with the nutrition, causes abnormal growths in the substance of organs, called tubercle, and the concurrent inflammatory results in addition to the chemical action of the vinegar or acetic acid, causes the death and breaking down of the organs invaded, the lungs for example. That this is not opinion only is shown by the fact that over 246 swine were, at his instance, destroyed by feeding on farinaceous food in a state of alcoholic and vinegar fermentation, the vinegar yeast traced in the blood, found in the excretions, and 104 of the dead swine were subjected to *post mortem* examinations and their lungs found broken down and diseased as in ordinary consumption.

In carrying out his experiments he took men in companies of six, all healthy and with no vegetations in the blood, and put them also upon farinaceous food containing alcoholic and vinegar fermentations. He lived with them himself, and kept them under a sort of military discipline, that they might eat no other food save coffee with sugar and milk.

He marched them out on the street for exercise, so that they should not suffer from inactivity. He made daily chemical and morphological examinations of the blood, sputa, skin, urine, and fæces. First came on diarrhea, followed always by the presence of vinegar yeast in the blood and excretions, and afterward, in the course of three months from the time of beginning the experiments, the men had consumption of the lungs as indicated by the physical signs of the chest. In this manner he discovered what has been described as a new physical sign of the pretubercular state, and thus renders it possible to detect consumption any time within one year before the breaking down of the lungs. This has more significance when it is remembered that medical men are well agreed that consumption can be handled if taken early enough. It is nearly a quarter of a century since Dr. Salisbury has been treating this disease, and the mode of treatment has been given to the world.

In SCIENTIFIC AMERICAN SUPPLEMENT, No. 198, is republished the treatment of consumption by Dr. Salisbury, taken from the *Virginia Medical Monthly*, September, 1879. From this we quote as follows:

"The cure is accomplished by getting the system in splendid condition. It is a disease arising from continued unhealthy alimentation, and must be treated by removing the cause. This cause is fermenting food and the products of this fermentation: alcoholic yeast and alcohol, vinegar yeast and acetic acid, carbonic acid gas, embolism, and interference with nutrition. Consumption of the bowels can be produced at any time in the human subject in from 15 to 30 days, and consumption of the lungs inside of 90 days, by special exclusive and continued feeding upon the diet that produces them; that is, food containing starch and sugar in alcoholic and acetic acid fermentation."

Now, these are not opinions, but the relation of facts from experience, which have been more or less fully brought to the notice of medical societies and prominent men in this country by Dr. Ephraim Cutter in corroboration.

Inasmuch as we have given the treatment of consumption on the Salisbury plan without committing ourselves pro or con, so also as historians of the day we have said what we have in order that all shall have a fair presentation of their facts and opinions based on these facts, but opinions not based on practical experience and study are not desired. Prof. Tyndall's letter has given this opportunity of alluding to this newly opened field, which so sadly needs cultivating. Certainly we think the evidence submitted shows that Dr. Salisbury has come nearer to the real intimate nature of consumption than Dr. Koch or any one we know of. There is a simplicity, directness, breadth, and positiveness rarely seen in the treatment of a medical subject. Indeed, it is doubtful if there are any such conclusive and extensive experiments, as to time and number, approaching consumption from so many points at once.

DETECTIVE FIRE ALARM BOX.

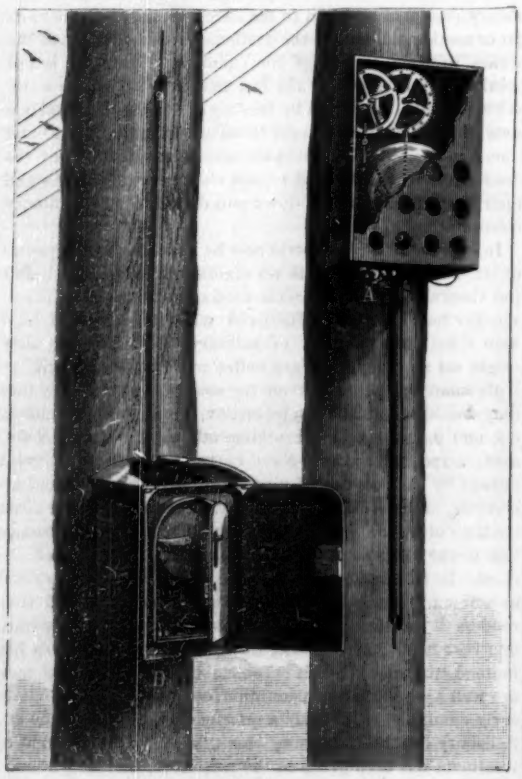
Fire alarm boxes, as usually arranged, are accessible for sounding an alarm by a door which is opened by a key, and any one in possession of a suitable key may give an alarm. A new and valuable invention for preventing and detecting the sending of false alarms has just been patented by Sergeant James J. Brophy, of the New York police department.

We feel satisfied that any who understand the working of this invention would be deterred from attempting to send a false alarm; and should any attempt it, they would almost certainly be detected. While it does not in any way interfere with the opening or closing of the box, the slightest movement of the alarm pull, or tampering with the connecting rod, will send it off. The invention is a mechanism for giving a local alarm only, when the pull by which the fire alarm is given is moved, and the usual construction of the fire alarm box is not changed.

In the accompanying engraving the ordinary fire alarm box, A, is shown fixed upon a pole, and the axis of its circuit closer extends through the back plate of the box to a space between the back plate and the pole, and within this space upon the axis is placed the devices for operating the local alarm, which is not accessible through the box.

On the pole, at such a height as to be accessible only by a ladder, is fixed the local alarm box, B, which contains a gong of large size, the hammer of which is caused to strike by the rotation of a spring barrel, to which it is connected by suitable devices.

Between the box A and the box B is a rod that is contained within an iron tube, so that it cannot be tampered with, and just beneath the box B the rod is provided with



BROPHY'S FIRE ALARM BOX.

a cross pin, that is to be used for raising the rod after an alarm has been given. The lower end of the rod is so attached to the alarm pull that the slightest movement of the pull will give the local alarm, and, the gong being large and the spring of striking device long, the noise is great and prolonged, and calls the attention of all in the immediate vicinity. After the alarm the fireman winds and sets the device, which is accessible only by means of the key, and it is ready for action again. The noise of the local alarm is so loud, and comes so suddenly, that the person giving a false alarm is sure to be detected.

The risk of life and property, and in many cases the actual loss, attending false alarms, would pay the entire expense of attaching the detective alarms to all the fire alarms of the city.

Only a few days since a false alarm called a number of companies to Forty-third street and Tenth avenue, and while they were away a fire broke out in a lumber yard at the foot of West Sixteenth street, and before the arrival of the companies had gained considerable headway, and came very near being a disastrous fire, and such cases are not unfrequent.

Further information with regard to this invention may be obtained from the patentee.

Exhibitions.

An interesting exhibition of foods, cookery, and the like, began in this city, May 15, under the auspices of the American branch of the "Union Universelle de l'Art Culir aire." The exhibition, to continue two weeks, is managed by some of the leading *chefs* of New York. It embraces groceries of every description, meat, provisions, poultry, game, fish, canned goods, dairy products, vegetables, fruits, flowers, confectionery, champagne, wine, liquors, cordials, ale, lager beer, mineral waters, dining room furniture, cooking apparatus and utensils, table linen, table silver and plated ware, and china and glass table ornaments, in fact, everything appertaining to the table. The society will award medals to exhibitors according to merit. These will be divided into two classes and an honorable mention: to the first class, a medal of gold, for superiority; second, silver, for excellence; the third, an honorable mention, for good quality. The judges will consist of New York business men. A dinner is served daily, illustrating in turn the gastronomy of different countries.

The exhibition of agriculture, mechanics, commerce, and art, now running in Nuremberg, Bavaria, is described as the largest ever held in Germany. There are upward of three hundred exhibitors, representing trade and industry, with interesting exhibits of raw products, materials partially manufactured, processes for art restorations, panels and other decorations of great variety, articles of trade, machinery, and general works of art.

The unfortunate destruction by fire, May 12, of the building set apart for the Berlin Exhibition for Hygiene and Life-saving, next summer, may delay, but will not prevent the exhibition. Liberal subscriptions have already been made toward a new building.

The Continental Exhibition which began in Buenos Ayres March 12 is said to be doing well. The exhibition was specially planned to foster South American industries, all foreign products except machinery being excluded.

An intelligent spectator at the inauguration of the exhibition was particularly impressed by the wonderful profusion of native products, especially from the provinces, and by the paucity of purely native industries. Although the city and province of Buenos Ayres make a good show in leather work, furniture, and carved woodwork, glass, inks, jewelry, millinery, carriages, typography, lithography, photography, liquors, beers, biscuits, metal castings, mosaic and tilework, etc., such was chiefly due to the intelligent foreign workmen resident there, making use to a very great extent of foreign material. On the other hand the ores, marbles, wines, cereals, wool, silk, hides, leather, tans, woods, lignite, medicinal herbs, rice, tobacco, sugar, cotton, fruits, manures, dried and potted meats, fossils, etc., of the interior parts of the country gave evidence of a future wealth which is boundless.

A singular exhibition is announced to take place at Rochester, N. Y., from June 19 to June 24, being a show of goods and appliances used in connection with the burial of the dead. A large building has been secured. Here will be shown the various apparatus and compounds for embalming, for temporary preservation of bodies with ice, all kinds of coffins and caskets, hearses, carriages, funeral fabrics, mourning liveries, funeral costumes for the clergy and for the friends of the departed; in fact, every item and feature pertaining directly or indirectly to the funeral business will be represented, with the latest improvements.

Unprecedented Immigration.

The immigration to this port during the last month is unprecedented in the history of the country. The total arrivals, according to the official files at the Custom House, were no less than 70,376, an increase of 9,100 over the same month in 1881. The total arrivals from January 1 were 142,716, against 109,123 for the same period last year, or an increase of about 23 per cent. Of the arrivals during April, 1882, 28,533 were Germans, or 39 per cent against 47 per cent of Germans in the immigration of April, 1881. The other nationalities were represented as follows: Ireland, 7,836; Sweden, 7,189; Italy, 6,391; England, 6,486; Holland, 2,691; Norway, 2,282; Denmark, 2,057; Switzerland, 1,794; Scotland, 1,199; Austria, 956; Russia, 775; Bohemia, 579; Hungary, 405; France, 385; Poland, 192; Wales, 117; Belgium, 99; other countries, 410. These figures, as compared with the arrivals in April, 1881, show that England, Ireland, Wales, Scotland, Holland, France, and Belgium about hold their own, while there is a falling off in the German immigration for the month, although a gain for the four months as compared with the first four months of 1881. There is a gain in the Italian immigration for April of more than a hundred per cent over the same month last year, and the proportion of increase runs about the same for the four months. There is also a gain of about 40 per cent in the Swedish immigration as compared with April, 1881. The increase of Norwegians is the greatest, there being 2,232 as against 317 for April, 1881. The Danish immigration is nearly a hundred per cent greater than in April last year, being 2,027 against 1,263. The Swiss immigration shows about the same proportionate increase, being 1,794 against 1,001. The sudden movement of the Russian Jews to this country increased the immigration of that nationality more than 200 per cent, but there is a greater proportionate falling off in the Polish Jews, there being only 192 during April, as against 2,114 in the same month last year. There is also a falling off in the Austrian immigration of about 30 per cent.

With the exception of the Italians and the Jewish refugees these new comers are for the most part well provided with money and household goods.

THE NEW EDDYSTONE LIGHTHOUSE.—The new Eddystone Lighthouse was formally opened May 18, by the Duke of Edinburgh. Commodore Luce and other American naval officers were present.

NEW TRACHEOTOME.

It is somewhat of an innovation for a regular physician to patent a surgical instrument; but the practice is coming into vogue of late for the simple reason that if it is proper that one doctor should receive a royalty in compensation for the labor he has bestowed upon producing a valuable medical book, another for the same reasons should be remunerated for similar work in bringing out a useful surgical instrument.

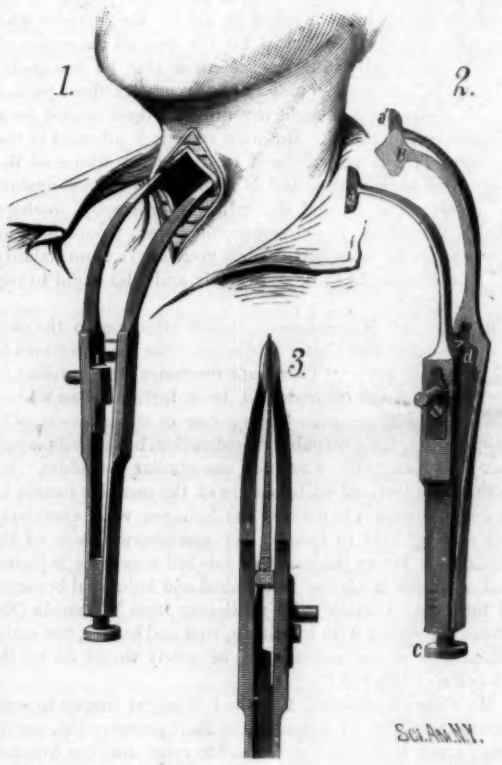
The accompanying cut represents a tracheotome designed to facilitate the operation of opening the trachea, or windpipe, in all cases requiring such a procedure; but is more especially useful in cases of emergency, as with this instrument the surgeon can safely proceed without having to wait until he can secure the help of skilled assistants.

Fig. 3 represents the instrument closed, ready for use, showing its under surface.

Fig. 2 shows it expanded, so that the spring arm and blade can be removed by loosening the thumbscrew.

Fig. 1 shows the instrument dilating the opening after the incision has been made and the blade removed.

a a' are two spring arms that have their outer ends curved to nearly a right angle with the body of the instrument, and their points are furnished with T-projections. The spring arm, *b*, is fastened to the heel of the instrument by the thumbscrew, *c*, which passes through a slot in the end of the arm, so that it can be readily removed. The outer portion of this arm is curved to conform to the arms, *a a'*, and on its extremity is formed a blade of peculiar shape, which, when the instrument is closed, projects beyond the T-extremities of the arms. By compressing these three arms the instrument is closed, the T-projections embracing the blade firmly, and



IMPROVED TRACHEOTOME.

the whole is secured by the slide catch, *d*, and the instrument is compact, firm, and ready for use.

In performing tracheotomy with this instrument the usual dissection is made until the trachea is sufficiently exposed, when the tissue is pressed back and the trachea grasped with the left hand and slightly compressed. The point of the blade of the tracheotome is then pressed upon the trachea, and by a slight movement as many of the rings as is desired are quickly cut, the lower borders of the projections acting as guides and preventing the blade from going too deep. The projections at the sides of the blade are then passed into the trachea, when the spring catch is drawn and the spring arms spread apart, and the blade is instantly thrown out of the opening and may be removed. The spring arms of the instrument tend to dilate the opening completely and keep it in that condition, and the T-projections prevent it from slipping out, and retain it until the surgeon desires to remove it. In urgent cases the tracheotome may be passed directly into the windpipe without making the preliminary dissection, and almost instantaneous relief is given to the patient. We are informed that the instrument has received the indorsement of eminent members of the profession.

Further information may be obtained by addressing L. J. Lyman, M.D., Manhattan, Kan.

The British Association.

The British Association meets this year at Southampton, beginning August 23. Dr. C. W. Siemens will occupy the chair. Meetings of the several sections will be held daily until August 29. The concluding general meeting will be held August 30.

Jumping Sheets or Fire Escapes.

An unhappy accident, by which an English fireman was seriously injured while practicing with the jumping sheet, has given rise to something like a revulsion of feeling with regard to their utility. The superintendent of the Manchester Fire Brigade has made inquiries to discover instances of their use in saving lives, during the years in which jumping sheets have been carried by European fire companies, and finds but one instance, in Vienna.

It is only when the person to be rescued is at a small distance from the ground—say, thirty feet or under, he says—that the sheet can be safely used; above that height those who jump run the risk of having their bones broken, while those who hold the sheet are liable to a spinal shock.

To be really serviceable in rescuing fire-beset persons from upper floors, the jumping—or, rather, catching sheet—should, in our opinion, be raised ten, fifteen, or twenty feet from the ground, on strong but somewhat elastic standards. In this way the fall would be sooner broken, the shock would be less, and would be met by the standards and not by human backs, and a longer time and space would be provided for reducing the momentum of the body gradually as it neared the ground.

Compartment Ships.

There is still a very grave doubt expressed in weighty quarters, says the *Marine Engineer*, as to the efficiency of the present much vaunted system of water-tight compartments for securing the safety of vessels after collision or other fracture of the hull. The late losses of the Douro and Yrurac Bat have been severe examples of the utter uselessness of the water-tight bulkheads, in those instances, at least. We fear that in any of the liners or large steamers, the sizes of the midship compartments are so large that they would, when flooded, suffice to sink the vessel beyond the side lights or port holes, some of which are sure to be open. As the bulkheads do not usually extend above the main deck, the water can rise above them and fill the other compartments by the hatch or companion ways, of which some are also sure to be open. In no case, to our knowledge, has a vessel received serious injury to her midship compartments in deep water and lived through it. Again, the bulkheads are by no means of sufficient strength to stand any very great water pressure, when to that is added the shock of waves. There seems little doubt that both the Teuton and the Yrurac Bat sank from this cause, while the Douro foundered from the size of the compartment that was filled with water.

NOVEL INDICATOR FOR WEIGHING SCALES.

We give an engraving of a device for indicating by sound the overbalancing of the scales, so that audible evidence of full weight may be given to purchasers.

An electric alarm is set in operation by means of a circuit closer operated by the arm of the scale beam, which receives the article to be weighed, and a wedge adapted to be moved longitudinally varies the position of the circuit closer with relation to the arm.

In the engraving, A is a box or counter top, within which there is an electric bell, B, of usual construction, together with a battery for operating it.

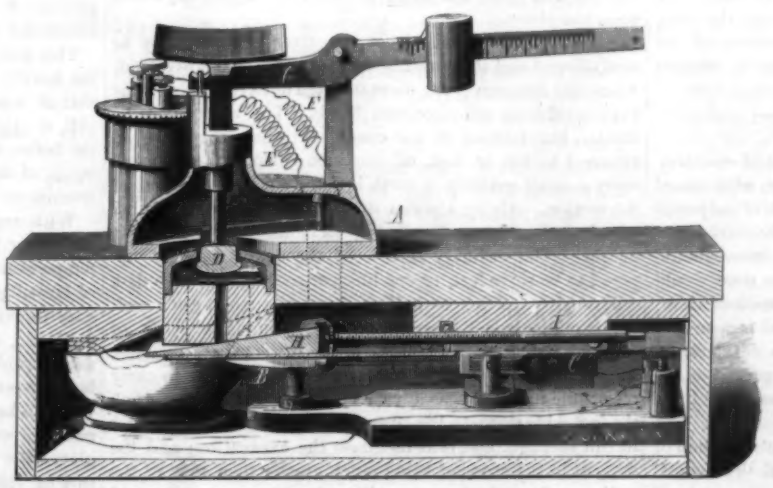
In the top of the box, A, there is a push button, D, which is held in an elevated position by a spring. This button is connected with the battery by means of a wire, E, and when depressed comes into contact with a wire, F, which extends to the bell, B, and thereby closes the electric current and sets said bell mechanism in motion in the usual way.

On the top of the box, A, over the button, D, is a pair of scales, G, which are so arranged that the depression of the end of the beam, upon which are placed articles to be weighed, will press down the push button, D, and sound the alarm, indicating the overbalancing of the scales, and enabling those interested to know that there is full or over weight upon the scales of the article being weighed.

In order that the vertical position of the push button, D, may be varied to adapt it to the scales, and to render their action certain, the inventor fits the casing of the button loosely in an opening in the box cover, and supports its lower end upon a wedge, H, arranged to move horizontally and longitudinally. The forward movement of the wedge operates to raise the casing, and a rearward movement to depress it. A threaded rod, I, having one end swiveled within the rear end of the wedge, serves to move the wedge longitudinally in either direction, as may be necessary for the adjustment of the push button.

The apparatus not only affords purchasers protection against light weight, but also assists the seller in weighing out articles by giving him warning whenever the necessary amount has been placed in the scales.

This invention was recently patented by Mr. Walton W. Wright, of Cairo, Ill.

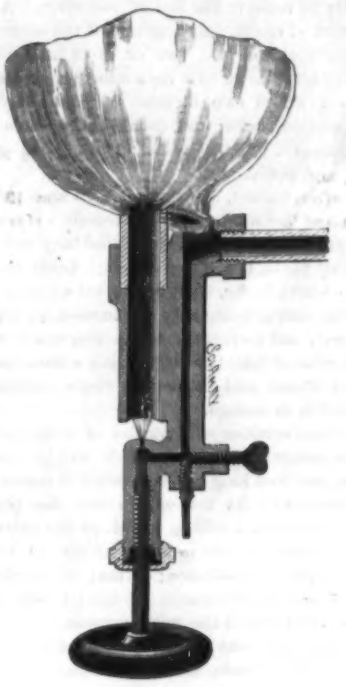


WRIGHT'S ELECTRIC INDICATOR FOR WEIGHING SCALES.

NEW VAPOR BURNER.

The engraving shows an improved vapor burner in which the slit in the burner tip is made slightly deeper on one side than the other, so that a portion of the flame which produces the light will be diverted so as to heat the inlet tube, and thus to vaporize the oil. This is done without in any manner interfering with the form of the blaze or the brilliancy of the light produced.

The object of the invention is to dispense with the usual subsidiary jet, and with the tubes which conduct a portion



BLAKE'S VAPOR BURNER.

of the gas to another part of the burner for the purpose of forming a subsidiary jet, and thus cheapen and simplify the burner.

This invention was recently patented by Mr. Wm. B. Blake, of Bedford, O.

Progress of the Hudson River Tunnel.

The engineers in charge of the Hudson River Tunnel now pronounce the experiment of boring from the New York side, on substantially the same plan as that resorted to on the Jersey City side, to be a complete success. While they have been coming to this conclusion the work has been carried on at the outlay of much perseverance and not a little risk, and has been marked by one startling occurrence which has not before been made public.

The New York *Sun* says that the engineer in charge, General Sooy Smith, did not have entire confidence in the plan of working with compressed air in the sandy, loose soil at the New York end of the tunnel. He feared that the air would work its way through the soil, and that the water could not be kept out while the workmen were building the tunnel. He dreaded a repetition of the accident of July, 1880, when by the caving in of a portion of the roof plating on the Jersey side one of the air locks was jammed and twenty men were drowned. Instead, therefore, of prosecuting the work on the plan which Colonel Haskin, the chief promoter, had so enthusiastically favored from the first, he preferred other and more expensive, though safer, methods, which he claimed would be also more expeditious. Finding that Colonel Haskin and the direction insisted upon proceeding as they had done from the first, he resigned his position and went West.

The occurrence referred to, which seemed almost to justify General Smith's fears, took place on March 31 last, when what is called a blow-out occurred. The compressed air forced its way out of the unfinished end of the tunnel, and this withdrew the force which kept the soft mud and water from rushing in. The men were forced to retire, which they did without accident, and for several days the excavation and the caisson were filled with water. Despair seized upon some of the engineers, and those who had favored old-fashioned methods declared that their predictions had been verified. But by the use of ingenious appliances the compressed air apparatus was again put to work, the water was driven out of the caisson and excavation, the leak was found and stopped, a section twelve feet in length was bricked up and completed, and the work of building the tunnel proceeded as before. The water could not be rapidly driven out through the holes at which it had entered, and a four inch discharge pipe was brought into play. As fast as the water lowered, the joints in the iron plates were made tight. When the water got low enough to enable the workmen to reach the principal leak, under water, that, too, was secured, until at length the whole tunnel was pumped dry, and the men were enabled to work with about the same density of compressed air as before—some twenty pounds pressure to the square inch above a normal pressure.

Several new expedients have been adopted to prevent similar accidents. The soil is so loose and sandy that it was thought best to decrease the size of the plates which are used to build the iron shell of the tunnel in which the brick lining is laid. The plates before used were 4½ feet long by 2½ feet wide. The exposure of so much surface of excavation gave too great an opportunity for the escape of air through the loose soil. Engineer Finch has reduced the size of these plates to one-quarter their previous area. Another precaution is the use of a bulkhead at the working end of the tunnel. This decreases the amount of exposed surface and makes it easier to keep the tunnel air-tight. Heavy bracing is used to support the roof, so that the roof plates may be kept in place until the brick casing is built. All these arrangements have proved successful thus far in enabling the engineers to bore in soft soil, such as has never before been tunneled by the compressed air process. The experience of several years and of the two main breaks has led to constant alertness. The slightest variation in the air pressure attracts attention, and instant search is made for the leak. The brickwork is kept up as close as possible to the iron shell, and the smallest amount of exposed surface that can be made available is kept open.

There have been several changes in the engineers. S. H. Finch, engineer in charge, is in charge of the New York side, and Charles Ward Raymond and Charles W. Clift are his assistants. The New Jersey end of the work was begun in September, 1879, and has progressed 1,000 feet in the longer tunnel and 600 feet in the other. About $400,000 has been expended on the work. It is estimated that the total cost will be about $5,000,000, and that the tunnel will be finished in four or five years. It has been a novel engineering work, prosecuted in spite of the adverse opinions of educated engineers.

Ventilation by Gas.

M. Arthur Morin, Director of the Conservatoire des Arts et Métiers, Paris, has carefully studied, with instructive results, the problem of ventilation by the aid of gas burners. For kitchens already built and provided with stoves of the usual pattern, ventilation may best be effected by lighting a gas burner at the bottom of a sheet iron air shaft. An example is given of a kitchen measuring 10 feet by 13 feet by 11 feet 6 inches high, having a content of 1,490 cubic feet.

It is proved by direct experiment that a common gas burner, consuming only 1½ cubic feet per hour, will create a draught in a sheet iron shaft 9½ inches in diameter and 26 feet high, sufficient to carry off 1,257 cubic feet of air every hour. A greater draught will, of course, be insured by a taller shaft; the delivery of a similar pipe to the preceding, but 52 feet high, being at the rate of 1,780 cubic feet per hour. Thus it is manifest that, with the aid of the ordinary kitchen fire, the air of a kitchen may in this manner be changed more than once an hour, and a constant movement of air toward the ventilating apparatus will be set up, which will effectually prevent all smell escaping by the doors to other parts of the house.

The gas burner need only be kept in action while cooking is going on, or, say, during six hours every day. The consumption of gas would therefore be only 8½ cubic feet daily, or 3,100 cubic feet per year; costing a mere trifle in comparison with the good it would have effected in preventing the dissemination of kitchen odors.

It is observed that the preceding calculation relates to sheet iron air shafts taken through the wall, and carried up to the roof in the open air. If the shafts were made of earthenware pipes, or built into a wall, whereby radiation would be prevented, the delivery of air through it would be much increased.

NEW ORE ROASTING FURNACE.

(*Continued from first page.*)

At the feed end of the furnace, in rear of the fire box, F, on a supporting frame, is a blower, delivering air into an air receptacle, from which an air pipe is extended through the flue at the end of the cylinder A, and centrally through the cylinder nearly the whole length thereof. This pipe is plugged at its inner end, and is provided with many lateral openings for the escape of air. It is surrounded by a fire clay pipe or jacket larger than itself, so that an annular space is left between the two pipes for heating the air; and the pipe or jacket is constructed in sections, with spaces between their ends for the escape of air into the cylinder A; and sections are held in place by spiders that radiate to the inner surface of the cylinder A, and are there fastened. The inner end of the fire clay pipe is also closed against the escape of air. Another air pipe enters the opposite end of the furnace and extends to an air receptacle, L, in rear of the dust collecting chamber, and from thence a pipe extends horizontally through the fire box and chamber, G, into the pipe, M, which carries the products of combustion from the fire box, and which is surrounded for some distance by the flue, H, and cylinder C, and terminates in a cross pipe, that is open at both ends and projects in opposite directions through the pipe, M, and flue, H, discharging air into the cylinder C. This air pipe is held in place by an encircling spider.

Over the fire box, F, is a feed hopper, N, from which the ore to be fed into the furnace, A B C, falls into a trough, whence it is conveyed by a screw into a conductor, which directs it into the end of cylinder A, as indicated Through the wall of the dust collecting chamber, G, at the top is introduced a horizontal shaft, having on its inner end a propeller fan, which is located above the fire box, G, where the two chambers communicate with each other. This fan creates a draught through the furnace, A B C, to the smoke stack.

By means of the salt and chemical box at the top of the cylinder A, suitable reagents are introduced into the furnace, A B C. This box is in the shape of a section of a circle, and is fitted with its inner curve upon the outside of the cylinder A, against the end of the cylinder B.

As the ore is fed into the furnace, A B C, it falls to the bottom, is caught in buckets, and is carried up. After passing the central line of the cylinder it begins to fall in thin sheets, and continues to fall regularly until each bucket in turn becomes emptied. In falling the ore passes through the air and heat introduced into the cylinder A, and strikes upon the bottom of the cylinder a little in advance of its starting point, depending upon the inclination given to the said cylinder. The ore is then again carried up and falls, and this process is continued until it falls into the cylinder B. In its progress through cylinder A, it becomes gradually heated, and the sulphur and other volatile or inflammable substances contained in it are either burned or volatilized and the ore oxidized. Near the end of the cylinder A the ore is met by an increased temperature from the cylinder B and fire flue, M, by which the sulphates still remaining in the ore are decomposed. The salt or other chemicals introduced here unite in regulated quantities with the ore at each revolution of the furnace, A B C, and together they pass into the cylinder B, and are there thoroughly mixed and ground together by the action of the balls, and any agglutinated lumps of ore are thereby pulverized, and any remaining excess of sulphur or other volatile substance escapes. The ore then escapes from the action of the balls through the side orifices into the buckets in the cylinder C, where, when chlorine gas is used, the ore is exposed to its action, and if chlorine gas is not used the ore is completely oxidized by the action of the air admitted through the pipe, L. The ore is carried by the action of the buckets of the cylinder C to the gathering trough, whence it escapes through the discharge pipe.

THE MISSISSIPPI RIVER.

There is, about this time, much discussion and conversation about the best mode of improving the river, with regard to the facilities of navigation, and protection of adjacent lands from overflows. It is well known that the river channel is constantly being filled up, so that if the levees should be raised six feet higher than heretofore, the time would come when they would be overflowed and washed away. What is wanted, therefore, is a deepening, and measurably straightening of the river channel. But this desideratum appears so enormously expensive as to be regarded as impracticable, especially as the channel might be liable to be again filled up and require redeepening.

Therefore there appears a necessity for the introduction of some system for the continuous deepening of the channel without any continuous expense.

The ordinary bed of the river is known to consist, to an indefinite depth, of fine soft earth or sand; and that whenever it is agitated a portion thereof is carried away by the current, which is much more powerful and effective at the bottom than at the surface, on account of the excessive weight of the water pressing upon it. If ten thousand men with long handled rakes were employed on each shore, to agitate and stir up the ground at the bottom, the water would carry off immense quantities of the earth, and deposit it in the great Gulf. Now, there is plenty of power in the current of the river itself to deepen its channel, if that power was judiciously applied to that purpose. But it is evident that no efficient apparatus could be applied to utilize this power without interfering with the navigation of the river, and requiring immensely expensive machinery. But there is another power, equally cheap, that might be applied for this purpose, and without encountering either of these great obstacles. Now, suppose the portion of the river most requiring improvement, to be one thousand miles in length; a chain of sufficient strength to lift 10,000 pounds may be furnished for five cents per foot, $260 per mile, $260,000 for the whole distance. Notwithstanding the crookedness of the river, the chain may be laid in sections averaging in length one mile each (some sections being four miles and others only 80 rods) in the bed of the river. At the end of each section of chain, and near one of the shores, there may be set a vertical iron pile, two or three inches in diameter, which may serve as an axle for a submerged octagonal wheel frame, over which two sections of chain may pass in the form of endless belts; and each section being endless, a double quantity, or 2,000 miles of chain, will be required, at a cost of $1,000,000.

These wheel frames, being submerged and near the shores, will be out of the way of passing vessels, even at low water. There must be a thousand of them, and they will cost, including the axle posts, ten dollars each. Upon the shore, and near each wheel frame, must be erected a planet wind wheel, of sufficient size and capacity to furnish an average of ten horse power, and connected to its respective wheel frame, by chain belts or wires, so as to give a moderate motion to the wheel frame and connected chain sections, when the wind wheel is in motion.

These chain sections will consist of links three feet long, and to the center of every tenth link will be attached a sheet iron cone, one foot long and six inches in diameter, pointing in the direction of its motion, so that the portion that is moving down stream will be aided by the current of water, while the cones that are moving up stream will encounter but slight aqueous resistance; so that if the chain was free from the frictional resistance of the bottom, it would be moved by the force of the water current.

These chain sections will constantly agitate and stir up the fine earth at the bottom, and in consequence the current will carry off an ounce per minute from each 30 foot section or cone, or by a more moderate estimate, one ounce per second from each mile of chain. This would amount to 5,760,000 pounds per day when in motion.

In many places, especially on sand bars, the chains would make two grooves six inches wide, and the current will enlarge them to several feet in width and depth within one week, and the two grooves or furrows would be worn into one, and continue enlarging until they would become the main channel. Moreover, the axle posts may be occasionally (once a year perhaps) removed, at trivial expense, and the chains would consequently take new ground, and the last chain at the Gulf may be extended into deep water, or diverge from the old channel, and take a short course into deep water, so as to shorten the distance by many miles, by forming a new main channel for the navigation of the river; for the winds will not fail, and a wheel frame may be located in the Gulf at any required distance from the shore.

These wind wheels, one thousand in number, will each present 2,700 feet of surface to the action of the wind, 900 feet of which will move square before the wind, and each will work ten horse power with a twenty mile breeze, and may be very permanently built for $200 each. They are not liable to damage by gales or hurricanes, and will last thirty years. The entire cost of the apparatus for 1,000 miles will not exceed $1,250,000; and in less than three years it will double the capacity of the river channel and secure the levees; and eventually, surely and infallibly, so enlarge the channel that there will be no occasion for levees anywhere upon the river.

Moreover, in several places the river channel may be straightened and shortened by extending the chains overland, where the distance is not more than ten or twelve miles, thus cutting off long and circuitous bends. The chains may be similar, but instead of the cones every link may have an attached button or disk, of one inch diameter, which will carry a small quantity of earth into the river at each end of the section. (Or by a series of transverse chains and wind wheels the earth may be piled up in mounds at intermediate points.) The ordinary motion of the chains may be supposed to be three feet, or one link per second, and each disk will remove and deposit half an ounce of earth at each end. The quantity removed would be 40,000 pounds per week, or 100 tons a year, to say nothing of the intermediate mounds. (Sixteen of these overland chains may be combined to carry off or pile up 1,600 tons a year.) These will work a ditch six feet wide down to the river, so as to allow the river water to run through, and thus facilitate the excavation; and the descent in the crosscut being much greater than that of the ordinary channel, the water will rush with greater force and eventually become the main channel of the river.

There is so little coarse sand or grit in the earth of the river bottom that the chains may be expected to last several years. It is not to be expected that the water will carry off all the coarse sand and gravel; but when a small new channel is formed the force of the water will be so much increased as to carry even small pebbles into the deepest places in the river. Pebbles of several pounds weight are often seen rolling down stream by the force of the current.

Captain Eads' system of jetties naturally tend to the washing away of the opposite bank of the river, thus increasing its crookedness and eventually filling up the deepened channel. But this new system of utilizing wind power will continue to improve the river and increase the value of adjacent lands, and will not be one-twentieth as expensive as the jetty system. Whatever objections may be surmised against it by interested parties, every scientific man who considers the subject will admit that it is, in the nature of things, the only possible way whereby the river channel can be prevented from filling up, and whereby the channel may be so enlarged and deepened as to prevent overflows and secure sufficient depth of water for all purposes of navigation, and especially through the most direct and shortest channel whereby the waters of the river enter into the Atlantic Ocean.

I am ready to furnish proper drawings and specifications to carry out the above work.

RUFUS PORTER.

New Haven, Conn., May, 1882.

NOTE.—When $1,500,000 worth of machinery is set in position, the natural pneumatic currents will aid the work by day and night, seven days in a week, to the average amount of four thousand horse power, which will be free of cost.

THE NEW PATENT BILL.

To the Editor of the Scientific American:

I notice in this week's issue of the SCIENTIFIC AMERICAN an article titled "Nullification of the Patent Laws," and more than agree with you in your condemnation of the new Patent Bill, which seems to me grossly unjust. I am a poor but honest patentee; my invention is a good one, and perhaps ere long I may be compensated, in a measure, for the hard earned money and many days and nights of toil and anxious thought it has cost me. But, if this new bill becomes a law, what is to prevent my shopmate, if he is so disposed, from secretly manufacturing my improvement, disposing of the same in quantities to peddlers, and so flooding the market against me?

Or, again, what is to hinder any of the rich, unscrupulous corporations, of which there are several in this city, from privately arranging with some man of straw to make my patented device in numbers sufficient to fit up their shops with them, at a price which barely pays for their manufacture, and then to buy the goods from him in open market as a trader, sooner than pay me the small royalty I ask? What is my redress? To sue either the maker or the seller would be useless, even if he could be found, for they are men without means. But how about the public, or those rich corporations who are using and enjoying my invention? Ought they not to compensate me for the privilege? The new bill says not, and moreover gives them the right to continue the use of that which was stolen from me, and which the Government, for a consideration, distinctly gave me a title to. Surely this is neither law nor justice.

New York, May 27, 1882. FOREMAN.

THE RECENT LAWSON BOILER EXPERIMENT.

To the Editor of the Scientific American:

The question asked by Mr. William Ord, in your issue of May 13, may be answered conclusively if he will admit the not unusual assumption that vapors obey the laws of Boyle and Gay-Lussac as if they were permanent gases.

A volume, *v*, of water, when converted into steam at a temperature of 212° F. and a pressure of one atmosphere, will occupy a space equal to 1,700 *v*. Raised to 400° F., at the same pressure, its expansion will be $1{,}700 \times \frac{1}{6}\frac{8}{7}\frac{9}{1} = 477$ *v*., and the total volume will be 2,177 *v*. If we compress this volume of steam isothermally into the limits of the boiler, which, in the absence of data, we will call 2 *v*, the pressure will rise to $\frac{2177}{2} = 1{,}088\frac{1}{2}$ atmospheres. In other words, a pressure 68 times as great as that recorded would have been attained if all the water had been converted into steam.

This result may be corroborated by another method. If the density of steam at 212° F. and one atmosphere is $\frac{1}{1700}$ that of water, at 400° F. and 16 atmospheres its density is $\frac{16}{1700} = \frac{1}{106}$, by Boyle's law. The weight of the steam in the boiler will be to the weight of the water as 1:106, that is, $\frac{1}{107}$ of the water has been converted into steam, while $\frac{106}{107}$ remains as water.

With regard to the "point or degree of heat where all the water in a boiler will become steam" (the "critical temperature" of Dr. Andrews), Maxwell says, in his "Theory of Heat," p. 124: "The critical temperatures of most ordinary liquids are much higher than that of carbonic acid (87·7° F.), so that experiments on the critical state of ordinary liquids are difficult and dangerous. M. Cagniard de la Tour estimated the temperature of the critical state of water to be 773° F." In this experiment "the critical temperature was so high that the water began to dissolve the glass tube which contained it." Therefore, at a temperature of 773° F. steam cannot be condensed into water, no matter how much it may be compressed. L.

A Mode of Hulling Wheat.

A Swiss process of removing the bran of wheat without loss of nutritive matter, consists in moistening the wheat before grinding with a solution of caustic soda in water. The solution is prepared by dissolving six and two-thirds pounds of caustic soda in one hundred and thirty-eight pounds of water. The steeping may be from fifteen to twenty minutes, and may be done in vats similar to those used by brewers. The caustic solution swells and loosens the hull proper, so that it may be removed by the slightest friction, leaving the gluten with the body of the grain.

Correspondence.

A Sod Bridge for the Platte River.

To the Editor of the Scientific American:

For various reasons, which will readily suggest themselves to the minds of your readers, a method for easily and cheaply bridging the Platte River (a wide and almost useless stream) is a great desideratum. The plan which I herewith inclose goes far to meet that "long felt want." Not only that, but it contains also the germ of a plan for converting an unprofitable river into a profitable canal.

DESCRIPTION OF DRAWING.

A, B—The banks of the Platte River, ordinarily not more than three feet above low water mark.

C, C—The prairie valley, covered with a tough, thick sod.

D, D—The bed of the river—shifting sand, several feet deep, resting on a firm substratum of gravel hard-pan. The river bed is very wide east of the junction of the South and North Platte, probably averaging one mile in width; and presents the appearance, during the greater part of the year, of a number of narrow, shallow waterways running through a vast sand bed.

E, E, E, E—Roadway approaches and abutments, built up of sod cut from the adjoining prairie valley.

F, F, F, F—Sheeting for the protection of road walls and abutments.

G—An iron bridge to cover the central third of the width of the river bed. The sod approaches complete the remaining two-thirds.

CHANGES WHICH THE CONSTRUCTION OF SUCH A BRIDGE WILL PRODUCE.

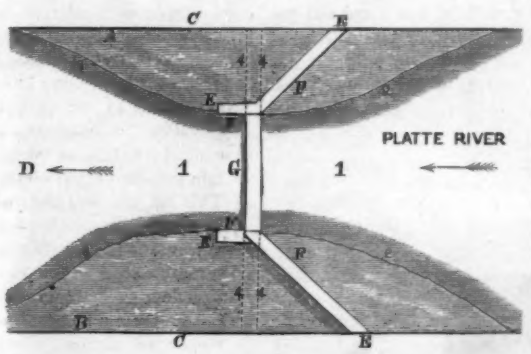
1. The increased force of the compressed current will cut out the loose sand between the abutments and deepen the channel at that point to the hard substratum of gravel, at 1, 1. Thus an ample waterway will be afforded for even the highest stage of water and ice.

2. A permanent deposit of sand will be made above the roadways, inside the dotted lines, 2, 2.

3. Permanent deposits of sand will also be made within the lines, 3, 3. These deposits will fill the whole space included between the sod walls and the river banks, and within three or four years will be very firm and overgrown with willows.

ADVANTAGES OF THIS METHOD OF BRIDGING THIS RIVER.

Economy, Efficiency, and Stability.—This not being a timber country, all timber for bridge building must be freighted a long distance at heavy cost; and bridge timber soon decays. Timber bridges, in this State, are expensive to build and expensive to keep in repair. The first cost of iron would be greater than that of timber, but it is practically imperishable, and not much of it would be needed. The annual expense for repairs to an iron bridge would be nominal. Sod



would cost nothing but the hauling, and no skilled labor would be needed in building the roadway approaches. Once up they too would be permanent, expenses for repairs would be nominal, and restrictions of speed in driving on them could be dispensed with. The *first* roadways will be more safely built at an angle to the descending current, the impact of which on the bank will be thus much lessened. After the lapse of a short time (not longer than three years) the *second* approaches can be built, cheaply and easily, on the "made land," straight from the river banks (that were) to the ends of the iron bridge, as at dotted lines, 4, 4, 4, 4.

Experience proves that sod is a useful and thoroughly efficient material for the purpose, and in the way I have pointed out—and that the physical changes I predict are produced by the causes mentioned. That experience was gained by an attempt to build a sod bridge across the Platte, within the limits of this county—an attempt which only failed for lack of energy and business capacity on the part of the projector, at least so it is said. Certainly the sod walls erected years ago are comparatively intact by the action of the water, and on the lower side of them is a considerable tract of "made land," overgrown with willows.

JAMES STIMSON, M.D.

Plum Creek, U. P. R. R., Dawson county, Neb.,
May 11, 1882.

Boiler Notes.

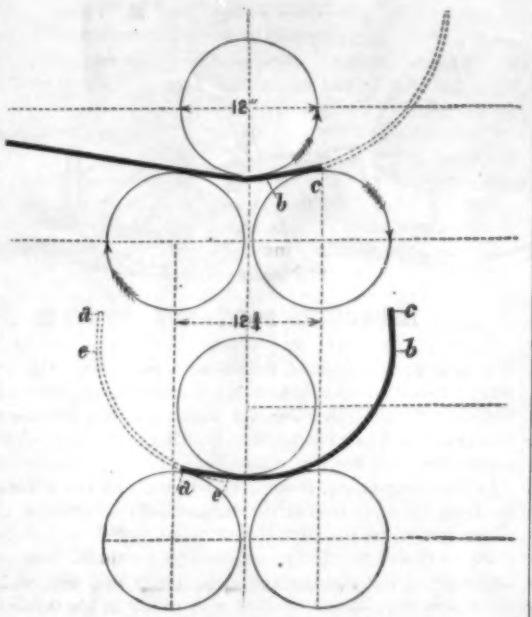
To the Editor of the Scientific American:

I was much interested in your remarks on boiler notes and sketches, showing a probable cause of defective sheets in steam boilers; also the article headed "Steam Boiler Explosions," from Mr. Parker. We are sorry that Mr. Parker, while explaining, by sketch and otherwise, the cause of the flat places left at the end of the sheet, did not, with his long experience, go a little deeper into the matter and point out to his fellow craftsmen how to obviate the trouble which is a great trouble to all boiler makers. Mr. Parker failed to state in his description that it is the end of the sheet coming through the rolls last which leaves the flat place referred to. We remedy this by slacking up our bottom roll and passing the sheet at the laps through the rolls. Another way would be to start one end of sheet through the rolls, then take it out and turn it and run it through from the other end, thus avoiding the flat place at end of sheet. But in practice, with heavy sheet, very few boiler makers care to do this.

I am a boiler maker, and I often see articles pointing out a very plausible cause, but failing to give any remedy.

If practical mechanics themselves would contribute a little of their practical experience and knowledge in place of being satisfied to simply read the ideas of others, it would bring to light a great many valuable ideas, which if expressed in a crude way might still be very valuable.

I. BARTON.



REMARKS.

With a view of testing the theory of our correspondent, experiments in bending a quarter inch boiler plate of ordinary quality were made by a representative of the SCIENTIFIC AMERICAN at one of the best equipped boiler shops in the country. The result, as shown in the accompanying sketch, was what we expected, namely, flat portions at each end of the plate from *c* to *b* at the entering end, and from *a* to *e* at the end coming out of the rolls. These experiments showed that results varied (*a*) with the thickness and stiffness of the plate, (*b*) with the radius of the arc made in the first passage of the plate through the rolls, and (*c*) with the size and adjustment of the rolls.

When space is available for a fuller discussion of this subject an adequate remedy will be suggested.

Motive Power from Steam Heating Pipes.

To the Editor of the Scientific American:

I desire to call attention to my plan for producing power at a small expense for fuel, in connection with my system of furnishing heat and power in cities from central stations. I have a steam supply plant in operation in St. Paul, Minn., where heat and power are furnished to a large number of buildings, the power, during the season in which the demand for heat is in excess of that for power, being produced at a very small expense by the following described plan:

In the boiler house of the central station two sets of boilers are located, one set to be run under a pressure of, say, 80 pounds; the other set to be run under, say, 150 pounds pressure. The steam produced in the boilers under 80 pounds pressure passes directly from the boilers to the street supply mains. In connection with the boilers running under 150 pounds pressure engines are operated, the exhaust steam from them passing into the street supply mains, mixing and passing on with the steam produced by the boilers running under the lower pressure. By this plan the power produced by the engines costs only the *actual units of heat* required to develop the power obtained; the exhaust steam, as it leaves the engines, carries with it all the heat it contained when first generated, less the small percentage utilized by passing through the engines.

The following estimate of the cost of power under the conditions named below are based upon data taken from W. P. Trowbridge's "Tables and Diagrams Relating to Non-condensing Engines and Boilers," H. Northcott's "The Steam Engine," and other works of similar import, with facts obtained by practical tests that have come under the observation of the writer.

Taking as a basis a 100 horse power engine, 17 x 42, cutting off at one-quarter stroke, running 60 pounds of steam, making 81 revolutions per minute, the exhaust steam going to waste.

Pounds of coal per indicated horse power per hour, 3·464; pounds of feed water per indicated horse power per hour, 31·800; cost of coal at $4.00 per ton for one year, running 10 hours per day, for 100 horse power, $2,806.00; units of heat expended per 100 horse power from 32° above zero to temperature due to 60 pounds pressure of steam, 3,729,680,000; units of heat actually transferred into indicated horse power under above conditions, 256,477,000; percentage of heat utilized, 6·89.

In the following table the same amount of power is to be developed, but the engine is to run under such back pressure that all of the exhaust steam can be used for heating purposes. The kind of engine used and the actual quantity of steam is immaterial, the only conditions necessary to make the plan profitable being that the total quantity of steam required for heating purposes shall be in excess of that required to pass through the engines in order to give the power needed: Pounds of coal per indicated horse power per hour, 0·2389; cost of coal at $4.00 per ton for one year, running 10 hours per day, for 100 horse power, $193.33.

There is a slight additional loss in radiation and leakage, caused by carrying a higher pressure, but this loss is much more than made up by purer water to feed the boilers with and the reduction in cost of repairs.

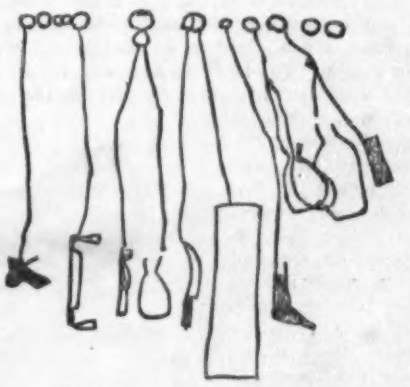
By the method described above power for any purpose may be produced, in connection with my system of furnishing heat and power on a large scale, at a small expenditure of fuel, but it is especially valuable as offering a practicable solution of the problem of cheap power for producing the electric light in cases where the business of furnishing heat, power, and light can be combined or operated in connection with each other.

E. F. OSBORNE.

Fire Wolf's Book Account.

In a letter to the New York *Herald* from Fort Keogh, Montana Territory, describing a Cheyenne settlement near that point, General James S. Brisbin says that the Indians are becoming skillful market gardeners, and give many evidences of industrial energy and thrift. Their trade is already considerable and much sought after by the village shopkeepers. Their credit is as good as gold, and anybody will trust them, for they never fail to pay. They do their principal trading at the post, and it pays the trader to keep an interpreter clerk. They have regular book accounts, and the sutler says he would rather trust them than many white men. They never fail to keep their obligations and always pay just when they say they will. They keep accounts of their own and know just what they owe.

General Brisbin was in the fort trader's store one day when an Indian named Fire Wolf was settling his account. He had a little book in which his accounts were kept in the following style:



The explanation of this remarkable attempt at Indian bookkeeping is as follows: First, he bought a pair of shoes, for which he paid $2.50, which is represented by the two upper large dots for dollars, the small dot half a dollar, the drawing of a shoe and the line connecting it with the dots. Then he bought a drawing knife, for which he paid $1.50—the big dot and a little one. Then he bought a monkey wrench and a paper of sugar for $1.50. Next he bought a knife and a piece of calico, for which he paid half a dollar each. The drawing lines and split dot represent this transaction. Then he bought a pair of stockings for half a dollar; next a small paper of coffee and a larger paper of sugar, half a dollar each; then a big paper of crackers and a plug of tobacco. He had paid for all these articles, except $2, which he owed, and he had come to settle his account. The debt is represented by the last two dots. His account agreed exactly with the book account in the store. After he had paid his account the store keeper tore out the leaf and gave it to General Brisbin.

A Remarkable Block of Amber.

Some fishermen of the Isle of Zuigst have fished up, opposite Stralsund, a piece of amber weighing more than eight pounds. It is 9½ inches long and 5½ inches in circumference. It is a most remarkable piece of amber, having all the qualities which distinguish the rarest pieces, color dark yellow, shining like glass, and not transparent. It is rare that a piece of amber weighs a pound. The piece, which is preserved in the Museum of Natural History at Berlin, weighs about 14 pounds.

IMPROVED PORTABLE ENGINES.

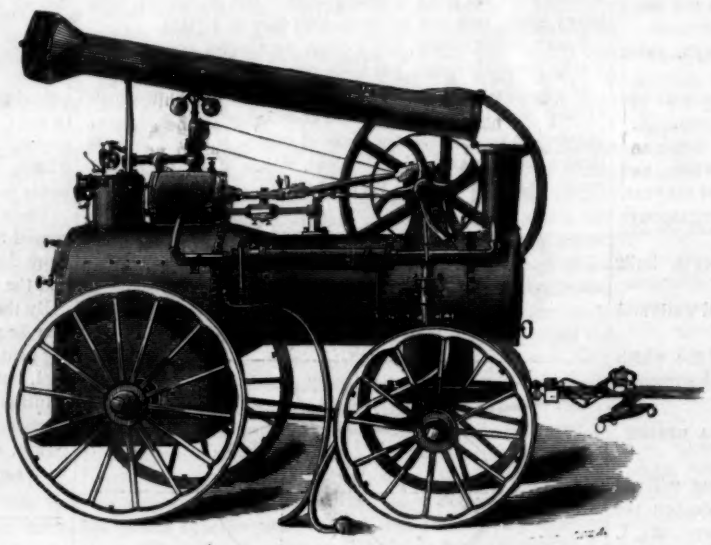
In these engines the cylinder and steam chest are cast together, the cross head guide is separate, which enables the manufacturers to do away with the heavy and unnecessary cast iron bed plate; the bearings are large and wide, reducing the friction; the cylinder is jacketed and covered with Russia iron. The crank shaft is double and extends beyond the bearings far enough to receive a pulley on either side; it is made of the best American forged iron. The guides are of an improved kind, and have very large bearing surface. The pump is driven by an eccentric from the shaft, and is bolted to the side of the boiler and is accessible at all times. The heater is large and well constructed. The governor is of an improved kind, and is so arranged that the speed of the engine can be altered while running. The boiler is made of the best American boiler plate; every sheet is tested to a tensile strain of 50,000, and the boilers are all tested to 200 pounds, and are fired and the engine run before leaving the shop.

A large wrought iron dome is placed on every boiler; this is greatly superior to those made of cast iron, as experience shows that cast iron is liable to give way at any time under pressure. The stack of this engine is made of heavy iron, and is very durable and has a very efficient spark arrester.

The engine and boiler is mounted on a strong truck or wagon; the wheels have cast iron hubs; the axles are made of the best refined wrought iron, and extend under the boiler without the objectionable bends sometimes used.

The engine is also mounted on skids when it is unimportant to have it perfectly portable.

For further particulars in regard to this engine, address the manufacturers, Phœnix Foundry and Machine Company, Syracuse, New York.



IMPROVED PORTABLE ENGINE.

Manufactures in Kansas.

When Kansas was admitted to the Union of States, twenty-one years ago, no manufacturing was done within its borders. The quarterly report of the State Board of Agriculture just received gives an abstract from the Assessors' returns of March 1, 1881, showing that there were in the State 208 flouring mills, with a capital of $2,953,067; 90 saw mills, capital $152,600; 9 establishments for the manufacture of agricultural implements, capital $71,200; 27 cheese factories, capital $60,800; 40 wagon and carriage manufactories, capital $150,900; 5 woolen mills, capital $68, 00; and 2 paper mills, capital $45,000. In addition to these, a large rolling mill is in operation at Rosedale, Wyandotte county, as are also extensive shops for railroad work. At Topeka, the Atchison, Topeka and Santa Fé Railroad Company have over $500,000 invested in repair shops, car building, and a complete establishment for railroad work in general. The large machine and repair shops of the Union Pacific Railway, Kansas Division, are located at Armstrong, Wyandotte county. In this county also are several large packing houses in full operation. The eastern portion of the State is underlaid with coal, and in many localities it is being mined in large quantities. In Cherokee county, in the southeast corner of the State, lead and zinc mines and manufactories are adding largely to the wealth of the State. Flouring mills, saw mills, foundries, woolen mills, and paper mills are numerous and in successful operation. The manufacture of sirup and sugar from the cane is developing into a large business.

The interest of sheep husbandry in Kansas has in the last two years increased rapidly. The ranges of pasture lands in the west are receiving recognition, and sheep are being brought in in large numbers. The increase since March, 1880, has been rapid. In that year the assessors' returns gave as the total number of sheep in the State, 426,492; in 1881, 806,323; while the estimates of reliable sheep men place the number, March 1, 1882, at 1,500,000. Woolen manufactures should follow.

The Fire on the Rio Grande.

The steamer Rio Grande, of the Mallory Line, from Galveston, Texas, to this port, was found to be on fire on the evening of May 16, when the vessel was about ninety miles from the Delaware Breakwater. The cargo consisted largely of cotton, in which the fire appeared to be. Captain Burrows soon had four large streams playing into the hold, but the fire was beyond control. At sunset the Rio Grande overhauled the Italian bark Beppino A., and though the weather was thick the passengers were safely transferred to the bark. The Rio Grande was then headed for the Breakwater, which was reached in the morning. Finding it impossible to extinguish the fire with the pumps, Captain Burrows scuttled the ship and sank her in water about twenty feet deep, the insurance steamer North America helping to fill the forward part of the vessel. This was twenty-seven hours after the fire was discovered. In the afternoon the ship was pumped out, floated, and dried. In the evening the Beppino A. arrived at the Breakwater; whereupon the passengers of the Rio Grande were retransferred and brought safely to this port. The management of Captain Burrows under the trying circumstances was much commended by those who owed their comfort and safety to his skill and courage.

A Large Boring and Turning Machine.

What is described as the largest boring and turning machine in the United States has just been set up in the establishment of McIntosh, Hemphill & Co., of Pittsburg, Pa. It weighs 235,000 pounds, or 110 tons, is 25 feet high, and occupies a space 30 feet square. It will turn, bore, and cut a key way in wheels of any size up to 16 feet in diameter by 11 feet wide on the face.

Civil Engineers.

The annual convention of the American Society of Civil Engineers took place in Washington, May 16. Gen. Wright, Chief Engineer, U. S. A., was elected permanent chairman; but being detained at home by sickness, his place was filled by Col. Casey. In his address of welcome Col. Casey referred to the works of interest to engineers about Washington, among them the great stone arch of the aqueduct, the largest span existing, the foundation of the Washington Monument, and the harbor improvements. The first paper was read by Capt. O. E. Michaelis, on "An Instance of Zymotic Disease in Metal." At the afternoon session, Mr. Chanute, Chief Engineer of the Erie Railway, read a paper on "The Preservation of Timber." Papers on the same subject were also read by J. P. Putnam, of New Orleans, and E. R. Andrews, of New York. At the evening session addresses were delivered by the Hon. Ashbell Welch, President of the American Society of Civil Engineers, and Col. Casey.

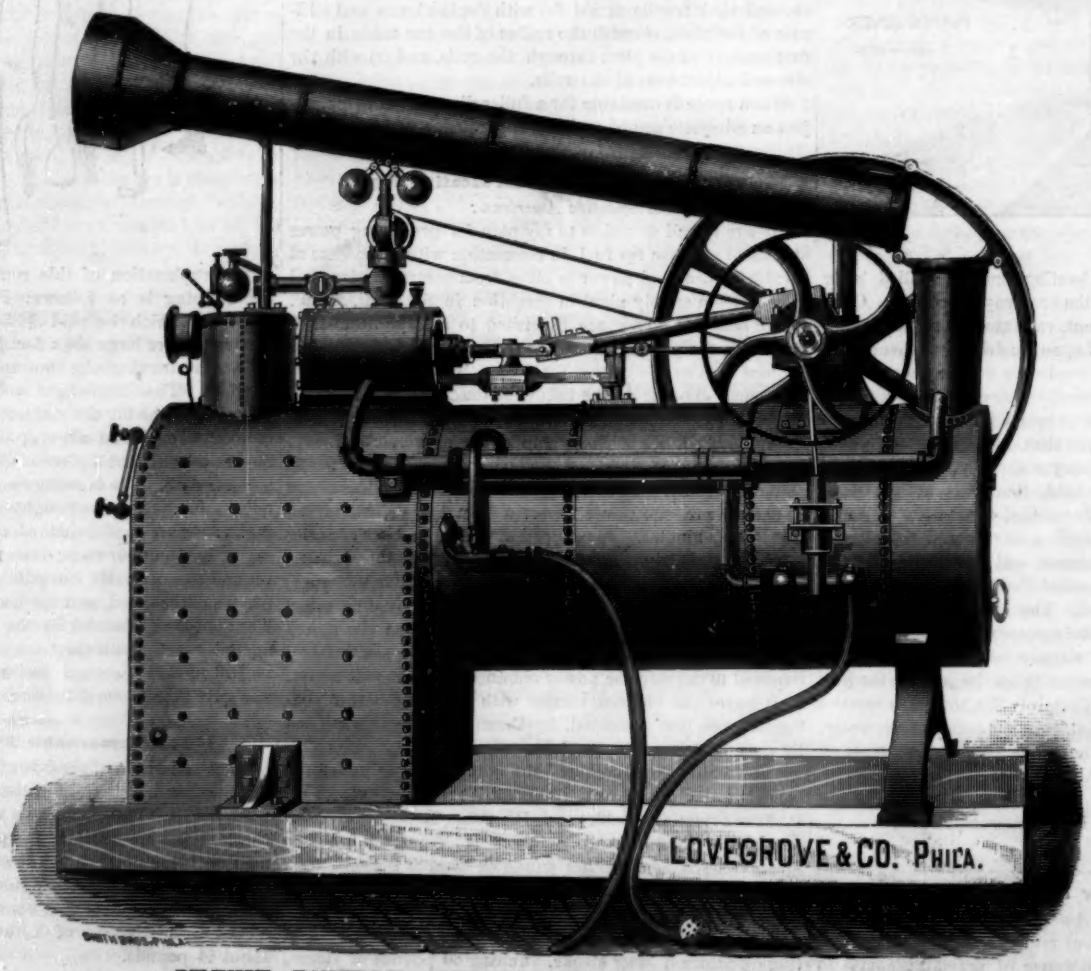
Winter in the Sahara.

A young French traveler, M. Gorloff, lately gave to the Royal Geographical Society an account of a six months' trip in North Africa, accompanied only by two Arabs.

During the whole of his journey they had frost every night. To the south of Ghardai was Metlili, the chamber city. The sitting room of its djemaa (the town council) was a subterranean gallery, ornamented with pillars, running round a deep well. By that contrivance the council was kept cool even in hot days. The men of the Touareg tribe are not allowed to have more than one wife, and she possessed the greatest influence, not only in domestic but in political affairs. The Touareg women are far more highly educated than the men. They could read and write well, they possessed some musical talent, and their poems were celebrated in the desert. It appeared that in the Middle Ages some persons of high birth emigrated to Africa among the Touaregs, and some of them boasted of Montmorency descent. At one time M. Gorloff and his guides were overtaken by a severe snow storm. The guides lost their way, and they were in much danger of being frozen to death. There were many in France, said M. Gorloff, who proclaimed the Sahara a rich country, where fortune was to be made. He would like those persons to travel in it. He thought they would then change their opinion.

Geology of Madeira.

As described by Mr. J. S. Gardner, a fellow of the English Geographical Society, Madeira consists almost wholly of sheets of basalt lava of variable thickness, interstratified with tufa, scoria and red bole, cut by innumerable dikes. In the central part of the island is a horseshoe-shaped valley, more than four miles in diameter, its bed 2,500 feet above the sea, its precipitous walls full 3,000 feet high, rising here and there to yet greater elevations, and forming a central point in the mountain system of the island. This Mr. Gardner regards as the basal wreck of a volcanic mountain, blown into the air by an explosion of exceptional violence. Fragments of the slopes of scoriæ, which once composed the inner shell, remain on the peaks surrounding this amphitheater. The dikes here are trachyte. Mr. Gardner describes a limestone exposed in one place beneath the basalts, and referred to the Upper Miocene, and a plant-bearing bed associated with them, containing fossils of species still living in the islands, some of which have been wrongly referred to extinct forms.



PHŒNIX FOUNDRY AND MACHINE CO.'S PORTABLE ENGINE.

THE steamer City of Baton Rouge lately made what is said to be the quickest trip on record between New Orleans and St. Louis, only excepting the famous run of the R. E. Lee, when, stripped for fast time, she raced with the Natchez. Fourteen stops were made; she had a load of passengers and freight; her time from port to port was 4 days 14 hours 25 minutes.

FILIGREE JEWELRY BOX.

We give an engraving of an exquisite filigree jewelry box of silver from the celebrated Gruenes Gewoelbe, in Dresden. In this repository many beautiful and valuable objects are stored. Our engraving represents this fine piece of silver work so well that it is unnecessary to enter into a detailed description of it.

Zinc in Bronzes.

At a recent meeting of the Berlin Society of Architects, some interesting remarks were made upon the causes of the black and green incrustations which time brings out upon oronze statues. It has often been observed that the atmosphere of modern cities is very unfavorable to bronze, giving it a dirty black color instead of the beautiful green patina which characterizes the ancient statues of the same metal. A committee of the Industrial Union recently undertook the investigation of the matter, and among other things noticed that a certain statue, that called the Alten Fritz, in Berlin, was entirely covered with a black coating, while a bronze cannon which stood in front of the arsenal near by was of a beautiful green color. As these two must have been subjected to the same atmospheric influence, it seemed very reasonable to suppose that the composition of the alloy might have been the essential condition in determining the black or green color of the patina, and an analysis was made, which showed that while the cannon was composed, like all of the so-called brass ordnance, of about nine parts copper to one of tin, the statue contained a considerable proportion of zinc. This is usually the case with modern bronze statuary, the substitution of zinc for tin in the alloy giving certain desirable qualities of fusibility, while the antique works have a composition very nearly similar to that of gun metal; zinc, which was unknown in Europe until the seventeenth century, being, of course, absent from the mixture. These indications that the substitution of zinc for tin is the true cause of the inferior color of modern bronzes were supported by the results of an experiment, in which several bronze alloys were subjected to the action of a solution of copper. It was found that under this treatment a composition of copper and tin alone acquired a green coating, while those containing zinc were blackened to a greater or less degree in proportion to the amount of zinc in the composition. To architects this investigation is of more interest than might appear at the first glance. Many of them, it is true, have occasion at times to direct works of sculpture in bronze, and it is certainly desirable to know the means of obtaining that rich green coloration of the antique statues which so many attempts have been made in modern times to imitate; but a much larger number are likely to be able to control the manufacture of bronze hardware, the value of which would be greatly increased if it could be used in its natural state, without any of the artificial coloring which so much of it receives, and with the certainty that age and use would only increase its beauty.—*American Architect,*

Sheep on Furnace Lands.

Ironton (O.) *Register:* Olive Furnace has over 600 sheep, including about 300 fine lambs. The flock doubled in the past year. They did not cost a cent through the past winter, except for a little hay that was given them when the snow was on the ground. The sheep ranged the hills and kept fat and healthy on the natural growth of the grasses and shrubbery during the winter. They required no care and were left to themselves.

The breed of the sheep are Cotswold and Southdown crosses, and are of a high grade. There are some specimens among them that a fifty dollar bill couldn't capture; and the growing lambs give promise of fine stock.

Mr. McGugin tells us that he is going to give the flock room to grow, and will make a business item of this branch of stock raising. He is of the opinion that for the care, capital and risk involved, he knows of no business that will prove more profitable. He calculates having some thousands of sheep within a few years.

This business has been demonstrated to be profitable on other occasions. Over 20 years ago Buckhorn Furnace proved there was money in it. The lands cost nothing. They are practically lying waste and are considered valuable only for the minerals within, the timber itself having long been removed. It is safe to say that 50,000 sheep could find subsistence on the unused hill lands of the furnace region of this country.

The Eclipse of the Sun, May 17.

The parties who went to Upper Egypt to observe the eclipse of the sun, May 17, were favored with good weather. Successful observations are reported from Soham, the station selected by the English, French, and Italian astronomers. A fine comet was discovered close by the sun and its position determined by photography. The spectroscopic and ocular observations, just before and during the period of totality, gave most valuable results, the darkening of the lines observed by the French astronomers indicating a lunar atmosphere. The spectrum of the corona was successfully photographed for the first time.

M. Charnay's Discovery.

The *World's* correspondent at Mexico reports, May 4, the arrival there of M. Désiré Charnay, bringing photographs of the newly discovered city on the left bank of the Usamasinta River, in Chiapas, near the frontier of Guatemala. M. Charnay believes this town was built by colonists from Palenque, because the ruins of the temples and houses, the inscriptions on the monuments, the sculpture and ornamentation are identically the same with those in Palenque. The discoverer of this ancient city has named it "Lorillard," in honor of his New York patron.

SILVER FILIGREE JEWELRY BOX.

Hardening Steel by Pressure.

From a communication made to the Paris Academy of Science Clémendeau has discovered a method of hardening steel which seems likely to become a very important one. The rod to be tempered is heated to a cherry red and put into a holder which just fits and then quickly subjected to enormous pressure in a hydraulic press. It is allowed to cool in the holder, and when taken out it is very hard. It is well adapted to making permanent magnets, and has already been used for telephones. This steel also makes excellent tools. The hardness may be regulated by varying the pressure to adapt it to different uses.

A Teredo-Guard for Ocean Cables.

At a recent meeting of the directors of a cable company operating in Chinese and Australasian waters there was exhibited a section of cable damaged by the teredo. So destructive was this gutta percha borer that the company had been put to an expense of $40,000 a year in taking up damaged cables; to save this outlay they were now putting down a ribboned cable at a cost of $300,000. A four-years' trial had demonstrated that by covering the cable with a brass tape or ribbon their attacks could be successfully resisted.

should follow.

PHŒNIX FOUNDRY AND MACHINE CO.'S PORTABLE ENGINE.

to port was 4 days 14 hours 25 minutes.

WHERE AGATES COME FROM.

Southern Brazil, and especially the province of Rio Grande do Sul, with the neighboring Uruguay, is the principal source of those stones which are sold under the name of opal, chalcedony, and agate. The trap rocks that penetrate the province in many directions, especially in the strip of high ground that branches off from Taguary, not far from the provincial capital, Porto Allegre, furnish considerable quantities of the finest agates, and in the greatest variety. They find their way mostly to Germany, and that too to the neighborhood of Oberstein. These semi-precious stones, which afterward develop great beauty, look very unattractive at first embedded in their dark colored clay.

Owing to the want of any railroad and the scarcity of wagon roads, it is necessary to convey them to the river in panniers on the backs of asses, mules, and horses. Of course before they are packed an effort is made to ascertain, as nearly as possible, the value of these ill-favored lumps of stone. Therefore many persons devote zealous study to testing and recognizing valuable nodules of agate, and those agate seekers who are practically as well as theoretically schooled in this are richly rewarded for their trouble.

The chief point in South Brazil for the collection of these semi-precious stones, and at the same time the seat of the agate exchange, which is still in its infancy, is the little city of Rio Pardo, at the mouth of a river of the same name, where it enters the Rio Jacuhy, one of the oldest places in the province of Rio Grande do Sul. Up to 1870 the agate exchange was ruled almost exclusively by a Swiss firm named Luchsinger. In front of their shabby little stores long trains returning from the inland country halt every week to pile up their rough stone treasures in and about the house. For months these heaps grew to small mountains, until their bulk and weight were sufficient for a ship's cargo, when they were shipped on the river sailing vessels called Lanchaoes to the port at Porto Allegre or Rio Grande.

The European destination of these rough agates, etc., is either Belgium or the home of the German agate polishers at Idar or Oberstein. The Brazilian semi-precious stones have a rival hard to conquer in the Indian carnelians, opals, agates, and jaspers, which come into competition with them at Oberstein, and pour in there uninterruptedly, and are at least as numerous as the former. Still the demand for raw material is very considerable, and since the Franco-Prussian war there has been an increase not to be underestimated from the return of hundreds of German agate polishers and engravers that have been driven out of Paris.

OBERSTEIN.

According to Mayer the Brazilian agates have been wrought at Oberstein for half a century, and have almost entirely crowded out the native raw material. Mortars, burnishing stones, cameos, clasps, bracelets, rosaries, cane heads, knife handles, and other trinkets are the articles for which important quantities of agate are used up year in and year out. The number of persons employed at Oberstein in polishing agates is estimated at about 6,000.

The working in agate has been known in that strip of land beyond the Rhine for centuries. Of more recent origin only is the co-operation of the portrait carvers, cutters, and gold workers.

In the course of time the Oberstein agate industry has developed from small beginnings to a branch of industry that is in communication with the whole world. Its intimate relations with Brazil probably date from the time of the first great emigration of Germans to Brazil in 1820. The persons who, according to the *Cologne Gazette*, sent over a cargo of stones in 1834, may have been lapidaries that migrated from Oberstein. Kluge puts the importation of Brazilian stones somewhat earlier, in 1827.

An agate exhibition at Idar, near Oberstein, in July, 1879, offered a striking picture of the state of this industry at that time. We are indebted, says *Ausland*, to this favorable opportunity and to the kindness of the well-known engraver, Mr. Charles Fuchs, of Kempfeld, near Oberstein, for the following description and statistics.

QUANTITY USED.

The agates which are brought from Brazil and worked up here annually amount to about 250 or 300 tons. The moss agates and heliotropes from India, which are used in Oberstein, are estimated at 300 cwt. (15 tons). The jaspers, which are found in the region of the Saar, are mostly blue, and are known in the market as real jasper, of which there are about 500 tons. Besides all these, there are used at Oberstein about 300 to 400 cwt. of so-called real lapis-lazuli, then amethysts, labradorite, obsidian, and quartz crystals.

There is a sale of such raw material almost every week, mostly at public auction and by weight. Under these circumstances the prices vary extraordinarily, as, for instance, from $37.50 to $500 per cwt., and not unfrequently still higher prices are paid. Stones, for example, that are found to be particularly adapted to making cameos and intaglios, have the highest value, and will bring $750 per cwt.

The Brazilian stones come to the Oberstein agate market in blocks weighing 10 or 15 cwt., and so on down to 10 lb., to be soon converted by the skilled hand of the polisher into every possible article of daily use or of luxury. The most ungainly, gigantic blocks are first broken up with hammers and chisels, and from the pieces which are still unwieldy and inconvenient, smaller ones are sawed out by disks set with diamonds, and finally out of these the agates are formed on large sandstone plates. The chief articles made at present, besides those already mentioned for ornamental purposes, are those for industrial uses, such as rollers for paper, stones for clocks and watches, compasses, smooth, and polishing stones, etc. In Brazil they know but one use for the round agate nodules, the natural stone bullets, and that is for bolas (stones used in throwing the lasso). At the present time the agate seeker in Brazil is, however, rarely able to collect his treasures entirely free from cost. Speculative Brazilian property holders have long been cognizant of the fact that when the agate balls are dug out of their property a possession is taken away which might bring them a small income. For some years past they have not allowed the agate seekers unlimited access to their lands, but demand that they shall either buy or lease the land.

Commercial agates are divided into two classes: natural stones and those that are artificially colored.

COLORING AND DYEING AGATES.

Red agates are often made in Oberstein by soaking them for a fortnight in nitric acid containing iron, and after drying them two weeks they are baked. The black colors are produced by warming them for fourteen days in a sweet liquid that contains honey, and then boiling them several days in oil of vitriol. Bright blue colors are obtained by the use of a bath of perchloride of iron, followed by yellow prussiate of potash. These are by no means all the colors that are produced artificially. A favorite shade of green is obtained by the use of nickel salts, followed by a soda bath. Yellows are obtained by crude muriatic acid or bichromate of potash. Favorite shades can be obtained by the use of chemicals if the stone is sufficiently absorptive. To determine this point an empyrical test is in general use at Oberstein and Idar. The buyer knocks off a thin sliver from the part of the nodule that seems likely to be useful, and moistens it with the tongue, noticing whether the moisture dries slowly or rapidly, and in streaks. If the absorption take place in varied streaks the stone is suitable for dyeing, and particularly for onyx colors. (In 1879 Cullman and Lorenz took out a patent in Germany for converting agate into onyx.) This test is not always sufficiently decisive to decide the value of the stone, so that agate dealers prefer to make a real test by actually coloring a piece of the stone.

The method of coloring agates, by the use of honey, was at first a secret that belonged to a few agate merchants at Idar. Formerly lapidaries from Rome (Romances, as the lapidaries of Oberstein and Idar called them) used to visit this region and buy up all onyx-like stones. From them these few agate merchants had obtained the secret either by trick or bribery. It is difficult to determine whether these Romans were led to it by Pliny, which is scarcely probable, since he only half describes it, or whether the art was not rather transmitted by tradition from Italy. Agates, or onyx streaked with white, which are frequently met with among the Brazilian stones, are by far the most in demand.

POLISHING AGATES.

In conclusion, we may give some account of how the Brazilian stones are wrought at Birkenfeld, in Oberstein. There are now about 200 polishing mills, where they had, in 1774, only 26.

THE MILLS.

In each mill there are four or five polishing stones, as large as a big millstone; they are, however, vertical instead of horizontal, and all attached to the same axle, on which there is also an overshot water-wheel. The millstones are of strong and firm quartzose sandstone from near Zweibrucken. Two men can work side by side on one stone, and this is almost always done.

TRIMMING.

Many agates are first trimmed to nearly the desired shape with a hammer, in the use of which the workmen become very skillful, so as not to lose too much material. It depends upon the knowledge of the natural structure of the mineral and the use of the cleavage directions. When the stone is valuable, and large flat surfaces are to be polished, they are often sawed off with a smooth saw, emery and water being used.

POLISHING.

While polishing the workman lies almost horizontal, with the front part of his body resting in a long, hollowed-out wooden bench, and presses the stone with his fingers, or a wooden holder, against the very rapidly revolving stone, which is kept wet by a trough of water. Ordinarily, one side of the polishing surface is provided with grooves corresponding to all the round, curved, or angular shapes which are to be given to the polished stones. The polisher can move his bench any way he pleases, just as a boy does his sled, by pushing with his foot against blocks of wood driven into the ground. In this way he is able to press the agate very forcibly against the polishing stone. This rather inconvenient position of the polisher, on his breast and belly, is absolutely necessary, for in no other way would he be able to closely watch the position of the stone on the polisher from above.

One might think, remarks Kluge, from whose work on "Precious Stones" the last few statements are taken, that this position would induce breast troubles in the workers, but he has been assured that this is not the case. The violent pushing with the sole of the foot readily elevates the breast, and raises it up from the front part of the bench. The polishers are mostly strong, healthy men. Of course they cannot work very long in that position, so that the workman has to rise up from time to time and assume an upright position, although it involves a loss of time.

The skill of the polishers is very great, and in fact it is astonishing how by skillful turning between the fingers a perfectly round marble is formed such as boys play with. (The same marbles are made in a far more simple manner from the Untersberg marble in the mills at Saltzburg.)

PHOSPHORESCENCE.

It is not surprising that there should be a continuous stream of sparks formed by the friction of pieces of agate against the hard grindstones; but the cause of the small agates glowing all through with a pinkish-white light, even in the day time, cannot be identical with that which causes the stream of sparks, but must be looked upon as a real phosphorescence produced by the jarring of the molecules.

The grindstones have to be frequently roughened on the surface (sharpened), so they will take hold better on the agates.

DANGERS.

It frequently happened formerly that the great velocity would generate such a strong centrifugal force as to tear the stones in pieces, which would not only kill the workmen, but destroy the whole works up to the roof. Great care has to be observed in selecting the grindstones, and those having any flaws cannot be used. In recent times accidents of this sort are not common, owing to the great care taken in selecting the stones.

Depressions, like those in dishes, vases, caskets, boxes, plates, etc., are made by small rotating stones, corresponding in size to the cavity to be excavated. For boring holes the tool is armed with diamond points, or steel borers are used with diamond dust on them. Finally, the polishing is done on vertical or horizontal disks of lead or tin, covered with ferriferous earth and water. Almost all the machines are geared to the main axle on which are the large grindstones, so that water power is used for all of them.

It might be supposed that the mechanical arrangements could be greatly improved, but in the great beauty of the work done these imperfections are forgotten.

Agate, it will be remembered, is nearly pure quartz, which has been deposited from solution in cavities, not unlike boiler incrustations, so that layers deposited at different times possess unlike density, and often unlike colors. This gives rise to banded agate, fortification agate, and many other beautiful and fanciful designs.

Long Bridges.

Mr. K. Pfarski has made a list of the longest bridges at present existing, which are the following, their lengths being given in meters—about 3 ft. 3⅜ in.: Parkersburg Bridge, 2,147; St. Charles Bridge, over the Missouri, 1,993; Ohio Bridge, near Louisville, 1,615; bridge over the East River, 1,500; Delaware Bridge, Philadelphia, 1,500; Victoria Bridge, over the St. Lawrence, 1,500; New Volga Bridge, near Syssran, 1,485; Hollands Diep Bridge, near Moerdyk, 1,479; Bridge over the Pongabuda, near Gooty (India), 1,130; Dniester Bridge, near Kiew, 1,081; Rhine Bridge, near Mainz, 1,028; Dnieper Bridge, in Pultawa (Russia), 974; Mississippi Bridge, near Quincy, 972; Missouri Bridge, near Omaha, 850; Weichsel Bridge, near Dirschau, 837; Danube Bridge, near Stadlau, 769; Po Bridge, near Mezzana Corti, 758; Tamar Bridge, near Saltash, 665; Leck Bridge, near Kuilenberg, 665; Mississippi Bridge, near Dubuque, 536; bridge over the Gorai River (India), 529; Britannia Bridge, near Bangor, 464; Saane Bridge, near Freiburg, 382; Theiss Bridge, near Szegedin, 355. The new Volga Bridge, near Syssran, is accordingly the longest in Europe.

The New Siamese Twins.

The brothers Tocci, born in Turin in 1877, are considered to be even more curious than the famous Siamese twins.

They have two well formed heads, two pairs of arms, and two thoraces, with all internal organs; but at the level of the sixth rib they coalesce into one body.

They have only one abdomen, one umbilicus, one anus, one right and one left leg. Their genital organs consist of a penis and scrotum, and at the back there is a rudimentary male genital organ, from which urine sometimes escapes.

It is a curious fact that the right leg moves only under the control of the right twin (named Baptiste), while the other is movable only by the left twin (named Jacob).

As a result, they are unable to walk. This left foot is deformed, and is an example of talipes equinus. Each infant has a distinct moral personality; one cries while the other is laughing; one is awake while the other sleeps. When one is sitting up, the other is in a position almost horizontal.—*Presse Medicale Belge.*

A New Style of Street Letter Box.

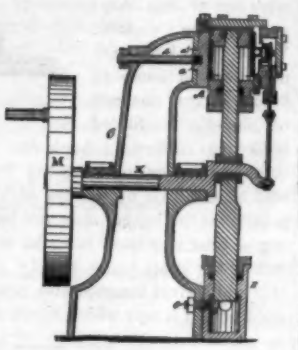
The Postmaster of Philadelphia has invented a new style of letter box. On the face of the box, at the bottom, is a notice of the time when collections are made by the carrier. Above this notice are the words: "Collections from this box reach the Post Office about ——," the blank being filled by the figures of a revolving disk, which changes each time the carrier shuts the lid, without any further effort on his part. The disk is made to note on it any number of collections, and when the last carrier of the day, who leaves the post office at midnight, visits the box, he opens and shuts the door until he hears the bell ring, which indicates that the dial is set for the morning collection.

architects this investigation is of more interest than might | eclipse of the sun, May 17, were favored with good weather. | tape or ribbon their attacks could be successfully resisted.

ENGINEERING INVENTIONS.

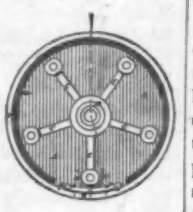
A Novel Steam Pump.

We find among the recent patents an improvement in steam pumps, by which the cylinders of the pump and engine are mounted in such a manner on a frame that they will automatically line themselves with each other. It is the invention of Mr. Campbell H. Osborn, of Clarksburg, Harrison county, W. Va., and is shown in the annexed engraving. C is the frame of the steam pump, A is the steam cylinder, the piston head and valves of which are of ordinary construction, and B is a pump cylinder, also of ordinary construction, except that it is provided with the screw-tapped hole, *b*, for receiving the screw bolt, *c*, by which the cylinder is pivotally secured to the lower face of the frame. The steam cylinder is cast with a hub, *a*, which is screw tapped in the center to receive the rod, *d*, by which the cylinder is likewise pivotally connected to the frame, the hub passing through a hole in the upper face of the frame, as shown. The piston rod of the engine and the plunger rod of the pump are formed with corresponding extensions or heads, the ends of which are perforated for the passage of the bolts that join the rods rigidly together, collars being placed upon the bolts between the extensions so as to leave a suitable space between the extensions to receive a cross head, through which the crank of the shaft, K, passes. By this arrangement, the cylinders being pivoted, and their rods joined together as one rigid rod, it will be seen that the whole are made universal in action, and that the cylinders will automatically accommodate themselves upon their pivots to the reciprocation of the rods, and will always be in exact line.



Engine Piston Packing.

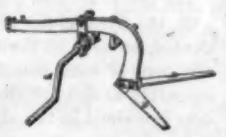
We give herewith an engraving illustrating an improved spring piston packing for engine pistons, that has been recently patented by Messrs. John Dykeman and Jason C. Corbin, both of Rondout, Ulster county, N. Y. The piston head is made with a hub to receive the piston rod, and with radial webs to support the face plate, D, the webs having screw holes in their enlarged outer ends to receive screw bolts that secure the face plate in place. The packing is made in the form of an open ring, and is held out, so as to bear against the inner surface of the cylinder, by one or more open ring springs, placed on the inner side of the packing ring. At its inner side upon the opposite sides of its joint and at a little distance from it are two cross ribs, between which is placed a short plate, J. This plate is curved upon the arc of the packing ring, and to the middle of its inner side is attached a U-shaped plate to receive the end of one of the radial webs. In horizontal cylinders when the packing wears the piston can be lined or centered by inserting thin wedges between the U-plate and the end of the web. The blowing of steam through the joint of packing ring is prevented by a tongue inserted in slots in the ends of the packing.



AGRICULTURAL INVENTION.

Cotton Stalk and Weed Cutter.

A new and useful invention for cutting cotton stalks, corn stalks, weeds, etc., has been lately patented by Mr. James H. Vannoy, of Farmington, Grayson county, Texas, and the accompanying engraving illustrates it. The device consists of an interchangeable cotton stalk cutter and sulky plow. A is the ordinary draw bail of a sulky plow, and to it is secured by hinged clamps an ordinary plow beam. In applying this improvement, the plow is detached from the beam, and in its place are secured the cutters, D. The inner ends of the cutters are formed with flanges through which are holes to receive bolts to secure them to the plow beam. The cutters project outward and rearward at an angle of about forty-five degrees with the line of the plow beam. When the plow beam is drawn forward the cutters cut off the stalks beneath the surface of the ground, and the beam and cutters may be raised and lowered by the same devices by which an ordinary plow is raised or lowered. The cutters may be of any desired length, and both or one of them may be used, as the character of the work to be done may require.



MISCELLANEOUS INVENTIONS.

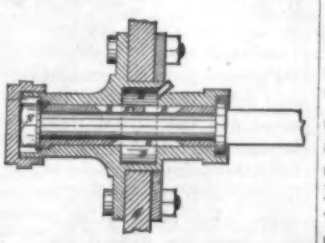
New Plastic Compound.

Mr. Bruno Harrass, of Böhlen, near Gross Breitenbach, Schwarzburg-Rudolstadt, Germany, has patented a new plastic compound that closely resembles wood, and is hard and elastic, and may be cut by the same tools as wood, and may also be colored, polished, and glued. The compound is composed of about three parts, by weight, of paper pulp or cellulose; starch about one part, and flour about two parts. Cellulose, which is sold as paper sheets, is dissolved in water and disintegrated, and placed in a fine sieve to permit the water to drain off. This mixture of cellulose, starch, and flour with water is boiled in a suitable vessel in a water bath for an hour, and is then cooled to the ordinary temperature. By being boiled the mixture is converted into a fibrous paste, and is then mixed with a suitable quantity of sawdust, and rolled into sheets and dried, when it is ready for use. It may be also pressed in moulds of sufficient hardness and strength, but the press and moulds must be heated and a sufficient pressure exerted. If objects made are to be veneered, from one to six sheets of thin veneering (covered on one side with some adhesive substance) are placed into the warmed mould. Upon these veneers a layer of one thirty-second to one-eighth of an inch thick of wood mass, colored the same as the veneer, is laid, and the object then pressed, when the veneers become so firmly united to the wood that they cannot be separated. The wood mass is obtained by mixing two to five quarts of cellulose, six to thirty of sawdust, one to five of dry dextrine, blood, rosin, or other binding material, powdered; one to five quarts of flour, one-eighth to two quarts of pipe-clay. Powdered color is added to give this mixture the desired tint.

Hub for Vehicle Wheels.

Mr. Francis T. Riegel, of Philadelphia, has patented a new device for lubricating the axles of carriage or wagon wheels, that is shown by the accompanying engraving.

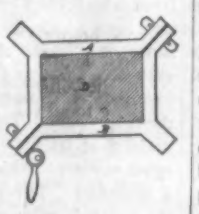
The hub of the wheel is made of metal, preferably cast iron, and has a longitudinal central aperture for the axle box fitting on the end of the axle. The central part of the hub is raised, and in it is formed an annular chamber around the axle box. Upon this raised part is an annular flange, against which the inner ends of the spokes are placed, resting at their ends on the raised part. They are held in their place by a flange composed of two semi-annular plates placed against the opposite sides of them and held firmly against them by screw bolts passing through the flange on the raised part of the hub and the semi-annular plates between the spokes. This flange, being made in two parts, permits either of them to be removed, to repair the wheel, without disturbing the other, or even removing the wheel from the axle.



The hub has a circular recess at its inner end for the collar of the axle, and at its outer end with a recess for the nut screwed on the end of the axle. The outer end of the hub is threaded externally to receive a screw cap on its outer end. The axle box has a longitudinal slot in its top and bottom, the one in the top being interrupted by a transverse piece near its center. The hub is also provided at the top and inner side of its enlarged part with a downwardly inclined tube, through which lubricants can be poured into the annular chamber, and the tube may be closed at its outer end by any suitable means, the chamber containing a considerable quantity of lubricant, and will last quite a long time.

Photo-Engraving Metallic Plates.

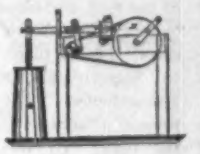
Mr. Alfred Michaud, of Paris, France, has patented a process and means of engraving metallic plates, to be used for printing and ornamental purposes, which he calls "galvano engraving." If it is desired to make an engraving, the inventor has prepared a suitable number of metallic plates, which have the smoothness and polish of glass, and having obtained a photographic negative of the subject to be engraved on a glass plate, he covers one of the polished plates with a bichromated gelatine film, and places the photographic negative upon it and exposes it to the light. The action of the light renders the gelatine insoluble, so that when the negative is removed and the gelatine plate washed, all the gelatine on the surface of the plate will be removed, except the duplicate of the lines of the photograph, which will remain in relief. The proof is placed for some hours in a damp place, when the lines are brought up in relief. The proof is then coated with plumbago, after which it is applied to a metal alloy placed in a special vessel hereinafter described. The alloy is then subjected to an ordinary pressure, and on cooling produces a hollow metallic plate ready to be printed. The fusible alloy that the inventor prefers to employ consists of bismuth, tin, lead, and mercury, the proportions varying according to the degree of hardness desired. A special vessel to contain the metal is constructed as shown in the engraving, the bottom being formed of a smooth, strong metallic plate. The liquid metal is poured into a vessel thus constructed, and the gelatine proof is immediately applied on the metal, and the whole is covered by a second smooth metallic plate which closes the vessel; it is put under momentary pressure. The mould thus obtained is quite ready for printing.



Motor for Churns.

Among the recently patented inventions is a motor for dash churns that is cheap, durable, and easily operated, and in which the length of the stroke can be varied to suit the size of the churn and the quantity of cream to be churned. It is shown in the accompanying engraving.

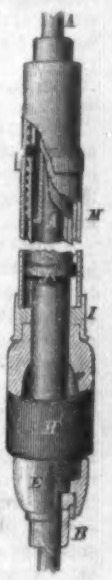
The frame of the motor is of suitable construction, having on its upper side a cross board, H, and at the front end of the frame projects upward guide arms. On the upper side of the crossbar is attached a short vertical board, I, perforated with holes. B is the drive wheel placed upon a shaft journaled in the sides of the frame, provided with a hand crank. A is a crank shaft provided with a pulley, over which the belt from the drive wheel passes and is connected to the dash lever by a connecting rod. The dash lever at its rear end is adjustably fulcrumed to the vertical board, I, and its outer end is adjustably attached to the upper end of the churn dasher. It will be readily seen that by this construction the motor is easily adjusted to its work, which it does effectively, and it occupies but little space when not in use.



This motor is patented by Mr. John L. Blackstock, of Stephenville, Erath county, Tex.

A New Packing for Oil Wells.

Mr. Jesse A. Heydrick, of Barnhart's Mills, Butler county, Pa., has patented an improved packing for oil wells. The annexed engraving is an illustration of the device. A is the tubing, two sections of which are connected by a screw threaded thimble, B. The lower end of the tubing extends to the bottom of the well, where it is provided with a plunger which works in a perforated barrel, X, that rests in the bottom of the well and is connected above to the outer casing by a reducer. The usual rubber collar, H, is used as a packer in connection with the following improved means, by which its efficiency is largely increased. The lower end of the rubber packing is screwed into a thimble, I, until it rests against an interior collar, and the thimble is screwed on to the upper end of the casing, M. The upper end of the packing is likewise held by means of a thimble, E, which screws on to it, and which by means of an interior threaded collar is secured to a cylindrical lining, F, to prevent the packer from coming in contact with the interior parts of the pump. The lower end of the lining, F, screws into a packer, J, consisting of a collar, which is inclosed by the walls of the casing, M. By an ingeniously constructed system of screw collars, packing rings, and thimbles, and of the nuts, B and C, by turning the tube, A, the packing, H, is expanded and made to fill the bore of the well, thereby thoroughly packing it.



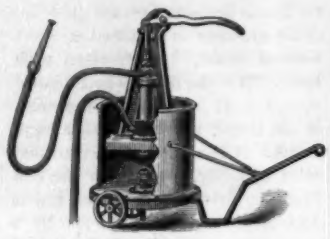
Improvement in Firearms.

A useful improvement in the lock mechanism of firearms, and one that is particularly adapted to revolving arms, has been recently patented by Messrs. Edouard Bled, of Paris, France, and Jean Warnaut, of Liege, Belgium. In the accompanying drawing, *a* is the hammer of the lock, carried on a pivot, made in one piece with the frame of the revolver, and provided with a pawl that causes the cylinder to revolve. The trigger also has its pivot made in one piece with the frame, and has a projection which passes between the lower part of the hammer and a projection, *f*, under the pawl. The main spring is double branched, its lower branch acting directly upon the trigger and its upper branch upon the hammer. When the trigger is pressed back its projection catches the projection, *f*, on the pawl, which, being pivoted on the hammer, brings it up to full cock and the cylinder is caused to revolve. As the trigger is pressed fully back its projection escapes from the pawl projection, *f*, so that the pawl and the hammer become free and are brought down with the main spring, firing the cartridge. When the trigger is released it is brought down to its first position by the action of the lower part of the main spring, and the pawl assumes its first position. The lower branch of the spring has a catch, *k*, so that during its downward motion it presses against a projection, *l*, of the hammer and brings it back automatically.

New Portable Force Pump.

Mr. Samuel Bosner, of Dover, Strafford county, N. H., has patented an invention which improves the construction of the portable force pumps for which letters patent were granted him March 1, 1881, so as to make them more convenient in use and adapt them to be used for various pur-

poses. The device is shown in the annexed cut. A tank made of suitable material is constructed with a ring flange around its bottom, to receive bolts by which it is secured to a wooden platform made of the same shape as the tank, and bolted to it. A little to the rear of the center it is secured to an axle and wheels. To the forward end of the platform is secured a bar, which is bent so as to form a foot to support the front of the tank and also to form a handle to draw it from place to place, and is strengthened by braces attached to the tank. To the middle of the tank is secured a stiff semicircular plate,

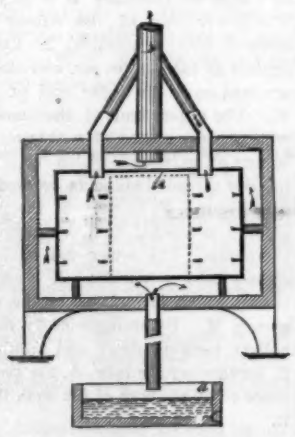


to which is attached the pump made in sections, and with flanges at the ends of the sections so that they can be securely bolted together and to the plate in the tank. The pump barrel has at its lower end below the valves an air chamber, which has an opening in its side connected with a flexible pipe, and at the other end of the pipe is a strainer. The upper part of the pump barrel is connected by a union to the end of a flexible pipe, on the other end of which may be placed a nozzle or sprinkler. The upper parts and the piston may be of ordinary construction, and are secured to a standard, the bottom of which is secured to the plate in the middle of the tank. As will be readily seen this pump may be used for a variety of purposes.

Refrigerator.

Among recent inventions we find a new refrigerator or milk cooler of such construction that the articles contained in it are cooled by a current of cool air circulating around the cooling box. The invention is shown in the accompanying cut.

A sheet metal box, A, is surrounded by a larger box, whereby an air space is formed around it. A pipe leads from the top of the box to the roof of the building containing the refrigerator, and projects a short distance above the roof, by which a strong draught is created. This pipe has two branch pipes leading into the top of the box, A. A pipe projects downward from the bottom of the box into a flat vessel located in the cellar and containing water, the lower end of the pipe being a short distance from

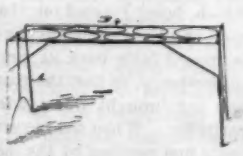


the surface of the water, so that all the air that enters it will be moistened, cooled, and refreshed.

The box, A, is provided with a door and slats. As there is a strong draught in the upper pipe the air is drawn out of the air space around the box, A, and is replaced by fresh, cool, and moistened air entering through the lower pipe, causing a circulation around the box and cooling the articles contained therein. This invention is patented by Mr. George B. Hurd, of Kiowa, Barbour county, Kan.

Filter Stand.

Among recent inventions we find an ingeniously constructed filter stand, formed with a series of funnel supports so that the stand is adapted to hold several funnels of different sizes at the same time, and also may be folded so as to occupy but a small space when not in use, that is patented by Mr. Henry B. Tiffany, of Clyde, Sandusky county, O. The stand is clearly shown in the annexed engraving, in which A are the legs or supports, and B is the main horizontal table portion of the stand, and is provided with a double series of orifices, in which the funnels are to be placed during the operation of filtering. The inventor prefers to make the stand wholly of wire, but it may be made of sheet metal or wood if desired. When made of wire the main frame is bent into the form shown, in such a manner as to form eyes at the corners. The series of orifices for the funnels are all formed of a single wire, and after being bent is secured to the frame by suitable means. The supports are bent of wires into the shape shown in the engraving, and the ends of them are looped into eyes of the main frame in such a manner that the legs are hinged to the frame, so that they may be folded upon it. When the legs are unfolded to support the stand for use, they are held in a vertical position by a strong wire rod, which is secured to one side of the main frame and to the legs by suitable fastenings.



Safety Lamp.

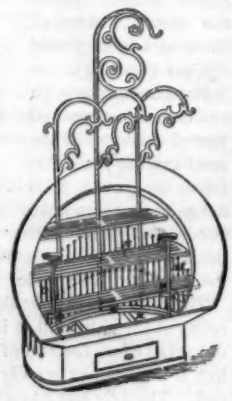
A novel and ingenious device, by which the danger from fire from the explosions of kerosene lamps is averted, is shown in the annexed engraving, and it is patented by Messrs. Célestin G. Tingry and George A. Siffait, both of Portland, Oregon.

A is the oil chamber of the lamp, that is surrounded by an outer chamber to receive a chemical compound that is of such a nature as to form a fire-extinguishing vapor when exposed to the air. The bottom of the outer chamber is either formed upon or securely connected with the pedestal of the lamp. The neck of the lamp is provided with a collar, into which is screwed a burner in the ordinary manner. In the upper part of the wick tube is formed a hole to receive a pin that passes through the wick and tube, and is designed to prevent the burning wick from being thrown out in case of an explosion. An oil feeding tube leads in through the upper part of the outer chamber and opens into the oil chamber,

A, for convenience in supplying the lamp with oil. An opening is also formed in the outer chamber for pouring in the extinguishing compound. Should the oil lamp explode or be broken the vapors from the compound in the outer chamber prevent the oil from burning.

Improved Flower Stand.

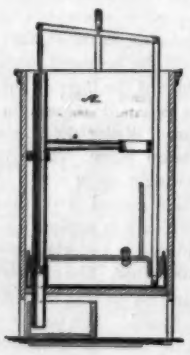
An improved flower stand that is ornamental in appearance and is so constructed that the plants may be watered without soiling or wetting the floor of the room in which the stand is located, has been recently patented by Mr. William D. McCallum, of Truro, Nova Scotia, Canada, and is shown in the annexed engraving. The stand has a semi-elliptical ground plan, the straight side being the front of the stand, and the curved sides increase in height from the front toward the middle of the side on a curved line. The upper edges of the sides of the stand are flanged outwardly and upwardly, and it is provided with one or more perforated shelves. A series of open flat tanks rest on the floor of the stand that serve to collect the water that drips from the plants, and the flanges around the sides collect the water that would otherwise fall on the carpet of the room when the plants are sprinkled. A series of rods, to which are attached ornamental or scroll-work arms, are suitably attached to the stand, so that the arms will stand directly over the pans in the bottom, and are for receiving vases and flower pots. The above described standard is very ornamental, light, and easily transported.



Wardrobe Shower Bath.

A new wardrobe shower bath that occupies but very little space and requires but a small quantity of water, avoiding the great waste of water that usually accompanies the shower bath.

This device has been patented by Mr. Edward N. McKimm, of Lathrop, Clinton county, Mo., and is illustrated by the annexed engraving. The shower bath is contained in a casing, A, resembling a wardrobe in appearance, and provided with a door. The floor of the casing, which supports the water tank, must be such a distance above the bottom floor from which the water is pumped, and into which the drip water flows, is placed. A pump tube extends from near the top of the casing down through the floor in the drip vessel. This tube is provided near its upper end with a spout or arm, to which is attached a sprinkler. The piston rod of the pump is pivoted to one end of a walking beam that is attached to the casing, A. To the other end of the beam is pivoted a rod extending downward to a crank-shaft journaled in the case, and the shaft has a double treadle plate, by which it is operated. By these devices the water is pumped from the vessel under the floor to the sprinkler, and running down forms a shower bath, the water returning through a pipe in the floor to the vessel from which it is pumped. The pump tube is raised by means of a lever to permit placing the vessel under the casing, and when the vessel is in position the pump tube is lowered.

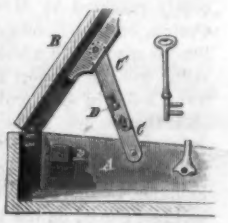


An Improved Buckle Attachment for Straps.

Mr. La Fayette Hartson, of Wyoming, Jones county, Iowa, has patented a novel and useful device for fastening buckles to straps, which is illustrated in the annexed cut. The buckle attachment is made of a metal strip of suitable length and width to suit the size of buckle and width of strap with which it is to be used, and is folded upon itself so as to embrace the end of the strap, and to receive and hold the bar of the buckle. The plate is slotted for the buckle tongue and perforated for holes for the passage of rivets, and is formed with one or two loops as may be desired. When two loops are used, as in hame or breast straps, one end of the clip is folded back so as to form a hook for protecting the strap from wear and preventing its being folded in a sharp angle. It will be seen that by the use of this clip a saving of leather results, as the leather does not have to be folded back, a saving of time and labor is made, as no sewing is required, the end of the strap being simply punched and placed in the clip and a rivet inserted and headed. The clip may also be used on old straps which could not be lapped and sewed.

Automatic Locking Stay for Desk Lids.

The device shown herewith is a self-locking stay for desk lids, awnings, skylights, trunks, show cases, etc., that will lock them open and closed, and support them when they are open. In the engraving a desk is shown having a body, A, and lid, B. C C′ are two flat metal plates, placed face to face, and pivoted together by a rivet passing through them within a short distance of their ends. The plate, C, has a slot in its pivoted end outside of the rivet, in which a lock bolt is movably held, the bolt having enlarged heads to prevent its disengagement. The pivoted end of the plate, C′, is cut away on one edge into a half elliptic curve, at either end of which is formed an L-shaped slot, and the extremity of the plate beyond the socket is formed into a hook, to secure the engagement of the bolt, D, in the socket when the device is closed. The free ends of the plates, C C′, are pivoted, one on the inside of the desk body, A, and the other on a cleat on the inside of the lid, B, in such a manner that the hooked extremity of the plate, C′, is downward when the desk lid is open. When the lid is raised and the stays are extended, the bolt, D, falls into its corresponding socket and holds the stays immovable, supporting the lid in an open position. When it is desired to close the lid the operator lifts the lock bolt from the socket and presses the lid down, the stays inclining inward at their connection, and their ends approaching each other. During the closing movement of the lid the lock bolt, D, is held in its socket until the lid is fully closed, when it falls into the socket of the stay, C′, and the desk is locked. The bolt falling by gravity, it is necessary that the stays be held at an incline, and a supporting stud is projected from the inside of the desk to prevent the depression of the pivoted ends of the stays. On the inside of the desk near the front is pivoted a stop, extending above the desk body, by which the lid is prevented from fully closing and locking. To unlock the desk a double fitted key is inserted at the key hole, K, and turned so that its bits straddle the edges of the stays and take hold of the lock bolt, forcing it back.



In the patent drawings several modifications of this device are shown, all substantially the same device. Further information can be had from the patentee, J. J. Igleheart, Columbia, Mo.

Gum from Algæ.

A new method of utilizing marine plants has been devised in France. The plants used are various forms of Atlantic and Pacific algæ, and the product obtained is a gum said to be variously useful in the arts, particularly in the manufacture of leather substitute.

The plants are first washed with warm or cold water, or both, the water either being pure or containing 10 per cent alcohol, or any of the following substances: Lime water, carbonate of soda, potash, carbonate of magnesia, or baryta, according to their smaller or larger quantity of cellulose, or salts contained in the algæ, which has to be precipitated. Before the extraction of the gum the plants may be dried, ground, broken, etc., according to their nature and according to the requirements. For the extraction of the gum hot water is preferred to cold, and steam to hot water. The extraction takes place in a conical vessel, the plants being placed on a false bottom, through which steam or water is made to pass through the mass. The quantity of water or steam used varies with the quality of the plants—15 to 20 times the weight of the plants will be the best proportion. To facilitate the action of the water for the extraction the plants are subjected to maceration. In order to obtain pure and transparent algæ gum, this must be diluted with much water: then it is left to settle, the temperature being kept at 50° to 60° C. The gum gelatinizes by cooling.

Business and Personal.

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The largest retail clothing business in New York and Brooklyn is done by Baldwin, the Clothier.

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See Bentel, Margedant & Co.'s adv., page 304.

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Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 341.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 340.

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Lathes.—20 inch swing, 8 foot bed, ready June 1. F. C. & A. E. Rowland, New Haven, Conn.

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4 to 40 H. P. Steam Engines. See adv. p. 325.

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The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 304.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 304.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 305.

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Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 324.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) W. H. H. writes: In your SCIENTIFIC AMERICAN SUPPLEMENT, No. 219, you give working diagrams and directions for building canvas canoe. I have partly built one, and would now like some further information in order to finish. What is meant by "deck camber?" A. "Camber" is the rise of the deck in center of width. 2. Upon what and where does the canoeist sit? A. Upon a light board fitted across the boat at the proper height. 3. Is there to be any rest or support for the back? If so, where and how is it to be fastened? A. A light back can be fitted to the seat or not as desired, but it is not usual.

(2) W. A. S. writes: I wish to know how I can melt rubber or dissolve it for the purpose of making rubber stamps. A. See "How to Make Rubber Stamps," SUPPLEMENT, No. 83. Pure gum caoutchouc (rubber mixed by kneading while soft) softened by ovening or steaming with about six per cent of floured sulphur is employed. Ordinary vulcanized rubber cannot be softened or melted so as to be used for such purposes.

(3) E. E. & C. C. O. asks what the best plan is for excavating a well through moderately soft rock. We have been digging a well, and have struck a soft yellow limestone, which is too hard to work with the pick, and ordinary blasting powder will do no good in it, as it seems to lose its force without lifting any stone. How would giant powder do? A. Giant powder would be more effective than ordinary blasting powder. It is now generally preferred to remove such rock by one of the forms of iron borers. See our advertising columns.

(4) W. H. R. asks: 1. What kind of prussiate of potash, red or yellow, is used for case hardening? If both, which is the best, and the best way to use it? A. Yellow, common prussiate of potash of commerce. 2. Can what is called German steel be hardened throughout like cast steel? A. Not in the usual way, but may by some special means. 3. Will you please name some good work on engineering, surveying, and leveling for a beginner? A. We do not know of any one book that would be sufficient. There are many elementary works that you could study with advantage. Write the book dealers who advertise in our columns.

(5) F. A. S. asks: What is the largest locomotive in the world; where was it built; where is it used; and what is the weight? A. The heaviest of the usual classes of locomotives is 55 to 60 tons. Experimental engines have, we think, been made as heavy as about 80 tons. We believe the heaviest have been made for the Philadelphia and Reading Road for the coal trains.

(6) J. L. M. asks: 1. How many sewing machines will a horse power run, large size, such as they use in shirt and overall factories, running at a speed of 1,300 per minute, Wheeler & Wilson? A. The average use of machines will require one-thirtieth to one-fortieth of a horse power. 2. How much is a horse power worth, to let? A. It differs in different localities according to cost of fuel, rents, etc.

(7) J. E. H. wishes to know what quantity of water will pass through a quarter inch jet per minute, under a pressure of 40 pounds, 60 pounds, and 80 pounds? A. Theoretically a quarter inch jet under 40 pounds pressure will deliver 9·2 gallons; 60 pounds pressure, 11·1 gallons; and 80 pounds pressure, 13·2 gallons per minute; but from these quantities a deduction must be made for friction, if the jet nozzle is attached to a long pipe. 2. Does the quantity vary in proportion to the diameter of the jets? A. For different size of jets the delivery is nearly as the area, not the diameter.

(8) N. C. S. asks if a chimney will draw any better if it be round than if it be square, or any other shape but round? A. The friction for a given capacity is less in a round chimney than any other form.

(9) F. G. B. writes: I have been greatly interested in the published report of Mr. Lawson's experiment with steam boilers, and while I long ago accepted the theory advanced by your paper, and since practically proved by that gentleman, I am not convinced that the results would not be identical if the cylinder were dispensed with and the immense volume of steam discharged directly against the atmosphere. My idea is simply that the large gate valve, suddenly opened, presents an area of escape corresponding to a break in the boiler shell; and that a boiler having the conditions of pressure and heat demanded in these experiments may be exploded by a sudden opening of sufficient area, whether in the shell or the large pipe connected therewith, without the intervention of a cylinder. Very high pressure and a very large outlet seem, however, to be imperative to produce an explosion. A slowly working valve and a properly proportioned steam pipe would seem to be the best safeguard where an extraordinary working pressure is necessary. M. Lawson's invention, however, may prove an ample preventive. A. The result would probably be the same, though the outlet to the cold cylinder may act to make it more instantaneous.

(10) C. M. asks: Are articles of oleomargarine and golden strup (composed in part of glucose) unwholesome as articles of food? A. Oleomargarine and glucose (when pure) are not unwholesome. 2. I have a bath room, 6x8 feet, 7 feet high, which I propose to warm to a temperature of 70° Fah. Will there be any economy of gas by using a gas stove or other radiator over a good Bunsen burner consuming the same amount of gas and air as the stove? If yes, in what way? A. A large radiating gas stove is preferable to the burner for heating purposes. Consult some recently published elementary treatise on heat.

(11) F. D. T. writes: Some time ago quite a lengthy article appeared in the SCIENTIFIC AMERICAN about superheated steam. I would like to ask if, in using a small boiler with a small amount of water in it, hot water could not be pumped in as fast as used and steam made and superheated to 300 to 400 pounds pressure without risk of explosion. Will the same fire that heats steam to 212°, in an ordinary boiler, raise it higher (and if so, how much), if the steam was in a separate boiler with no water in it. What would be the result if, in using a small amount of water, the pump should cease to act and the boiler become entirely dry? Would there be danger of explosion, providing the safety valve was in good working order? I understand that very small boilers can be made to resist a pressure of 500 to 600 pounds. A. You cannot safely superheat steam except by special arrangement, say in a separate vessel from the boiler, or something equivalent to it. Producing steam by injecting the necessary quantity of water on to hot metal, has been frequently tried, is attended with no advantage, and is not safe except in very careful and competent hands.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

May 9, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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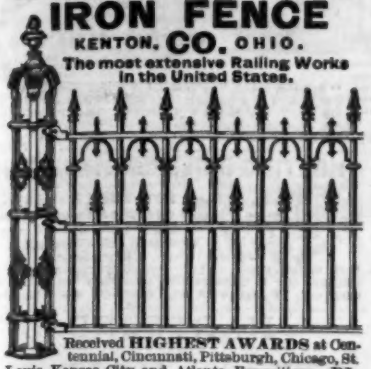

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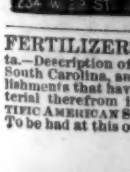

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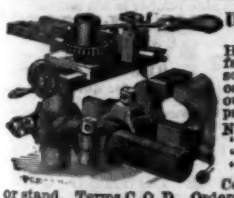

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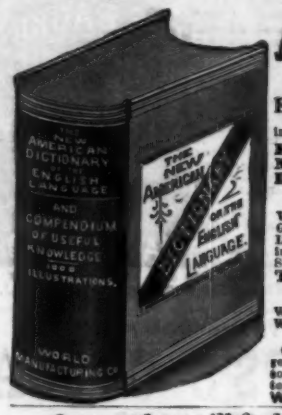

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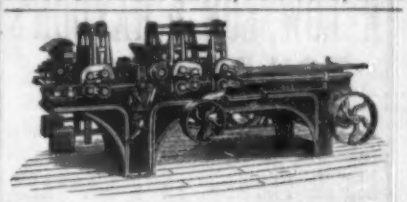

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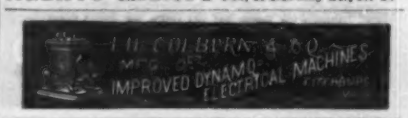

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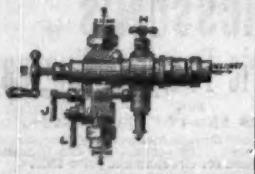

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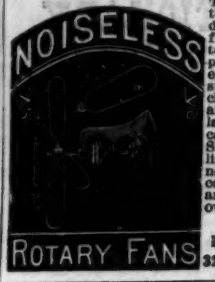

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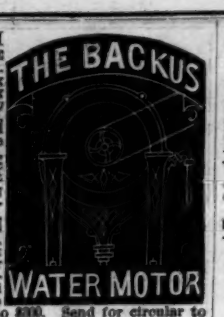

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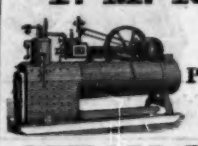

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